ANTECEDENTS OF SECONDARY SCHOOL STUDENTS' CHOICES OF SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS CAREER IN PENINSULAR MALAYSIA

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MARCH 2022

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By

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A thesis submitted to the Faculty of Arts and Social Science,
Universiti Tunku Abdul Rahman,
in partial fulfillment of the requirements for the degree of
Doctor of Philosophy (Social Science)
March 2022

ABSTRACT

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Tiny Tey Chiu Yuen

Malaysia will need eight million science, technology, engineering, and mathematics (STEM) workers by the year 2050. Despite the urgent demand, students tend to turn away from STEM careers, thus a STEM-oriented curriculum has been implemented nationwide to promote STEM education and prepare all upper secondary school students for STEM careers. However, there lacks a research-validated framework that describes students' STEM career choice intention in the Malaysian context. Previous studies used similar variables reflected in the theory of planned behaviour (TPB) in career choice research, but they were not based on the TPB. Therefore, this study is aimed to determine factors influencing STEM and non-STEM students' career choice intention through the TPB. The hypothesised predictors were perceived behavioural control, attitude towards career choice, subjective norms, media exposure, financial reward, and career interest. The role of the mediators (attitude towards career choice & career interest) and a moderator (streams of study) were also assessed in this study. Through proportional stratified cluster sampling, data were collected from 806 Form Four students in Peninsular Malaysia. Data were analysed using IBM SPSS Version 23 for preliminary tests. Consequently, 786 responses were retained for structural equation modelling using AMOS Version 23. Results from hypothesis testing and model validation revealed that 13 out of 23 of the hypotheses were supported by the data of this study. The main findings include (a) all proposed antecedents except career interest significantly influenced students' STEM career choice intention in which subjective norms was the strongest predictor, (b) attitude towards career choice was the only significant mediator in the model, and (c) a significant difference in STEM and non-STEM students' career choice was confirmed. This study concluded that the TPB-based model and specified models for STEM and non-STEM streams can be used to develop strategic initiatives for students in Peninsular Malaysia.

ACKNOWLEDGEMENTS

I would like to extend my gratitude, appreciation and thanks to a special cast of amazing people who have helped me with the completion of this thesis. Words are insufficient to express my appreciation for all these remarkable individuals.

Assistant Professor Dr Priscilla Moses is my thesis supervisor who has been a constant source of support throughout my entire scholastic journey. She has also been my advisor since my first degree that her support and advice have been very valuable to many important steps I made over the years. My achievements are inseparable from her support. I thank Dr Priscilla for her guidance and critiques as she witnesses my growth as a scholar and a person.

My co-supervisor Associate Professor Dr Cheah Phaik Kin is a role model who is genuine with her advice. Despite her busy schedules, she always cares about my well-being, spares time to listen to my concerns, and cheers me on towards the finish line. Her generosity and candour have also given me many invaluable opportunities to work with experts from other fields. My PhD journey has been particularly worthwhile with professional and personal support from Dr Cheah.

I would also like to acknowledge UTAR research scholarship scheme for funding my doctorate studies. The financial support I received from my university has helped me make through the training in research over the three years. I am very grateful to the Ministry of Education Malaysia and the state education departments for approving my research. To the school principals, teachers and staff who answered my requests when I was just a stranger calling and emailing them for data collection, I sincerely thank all of them for their kindness in helping me to complete the research. Also, I would like to express my gratitude to all respondents who spent time and effort in this study. The data collection exercise would not have been completed without their voluntary participation.

Next, I would also like to record my special thanks to the experts who have offered their professional assistance. My sincere appreciation to Distinguished Professor Timothy Teo, Distinguished Professor Fu-Yun Yu, and Professor Wong Su Luan for validating the research instrument. I am also grateful to language experts Mr Zulkufli bin Mahayudin, Ms Kock Yoke Leng, and Ms Asha M Vanugopal who helped with the translation process. My sincere appreciation also goes to Associate Professor Dr Cham Tat Huei for his guidance and comments on data analysis. I would also like to mention my friends and former colleagues Mr Chan, Hon Yu, Ali, Caryn, Wan Ruh and Yani, as well as my undergraduate research assistant Chiew Jie Xiang (Jack) who aided me when I needed help from their expertise.

My family members who have given me much freedom and confidence have been a great support in my pursuits. I would like to dedicate my heartfelt appreciation to my father who asked me to focus on my work and not to worry about him when he fell sick. I also thank my mother who is concerned about her

eldest daughter's well-being; my sister Ginny who stands by me like a friend; and my little brother who sees his big sister as his role model. I would not have attempted this endeavour without their love and trust.

I also appreciate all my friends for their timely text messages and calls that I wish to let them know that these actions are truly heartening. A special dedication to my dear friend Bao Er who is a good listener and has walked me through ups and downs. I am also very grateful to XIN who has magic in her words and presence that I have gained so much strength from her. Not forgetting my friends from far and near especially for their love.

Lastly, I must mention my deepest gratitude to Mr Renu Kailsan who passed away in November 2019. His encouragement, teaching, and wise words have shaped me into the person I am today. Mr Renu will remain as my inspiration, and I will fondly remember him as my teacher, my mentor, my father, and my best friend. He will always hold a special place in my heart.

APPROVAL SHEET

This dissertation/thesis entitled "**ANTECEDENTS OF SECONDARY SCHOOL STUDENTS' CHOICES OF SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS CAREER IN PENINSULAR MALAYSIA**" was prepared by TINY TEY CHIU YUEN and submitted as partial fulfillment of the requirements for the degree of Doctor of Philosophy (Social Science) at Universiti Tunku Abdul Rahman.

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SUBMISSION OF THESIS

It is hereby certified that I, Tiny Tey Chiu Yuen (ID No: 1804012) has completed this thesis entitled "Antecedents of Secondary School Students' Choices of Science, Technology, Engineering, and Mathematics Career in Peninsular Malaysia" under the supervision of Assistant Professor Dr Priscilla Moses (Main Supervisor) from the Department of General Studies, Faculty of Creative Industries, and Associate Professor Dr Cheah Phaik Kin (Co-Supervisor) from the Department of Public Relations, Faculty of Arts and Social Science.

I understand that University will upload softcopy of my thesis in pdf format into UTAR Institutional Repository, which may be made accessible to UTAR community and public.

Yours truly,

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Tiny Tey Chiu Yuen

DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UTAR or other institutions.

Name: Tiny Tey Chiu Yuen

Date: 24 March 2022

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LIST OF ABBREVIATIONS

AMOS	Analysis of Moment Structures
ASM	Academy of Sciences Malaysia
ASV	Average Squared Shared Variance
AVE	Average Variance Extracted
CFI	Comparative Fit Index
CFA	Confirmatory Factor Analysis
CR	Composite Reliability
EDA	Exploratory Data Analysis
GOF	Goodness-of-Fit
GFI	Goodness-of-Fit Index
MSV	Maximum Shared Variance
KBSM	Kurikulum Bersepadu Sekolah Menengah (Integrated Secondary School Curriculum)
KSSM	Kurikulum Standard Sekolah Menengah (Secondary School Standard Curriculum)
MOE	Ministry of Education
RMSEA	Root Mean Square Error of Approximation
SEM	Structural Equation Modelling
STEM	Science, Technology, Engineering, and Mathematics
SPM	Sijil Pelajaran Malaysia (Malaysian Certificate of Education)
SPSS	Statistical Package for Social Sciences
TLI	Tucker-Lewis Index
TPB	Theory of Planned Behaviour
VIF	Variance Inflation Factor

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

STEM is regarded as key to innovation that will drive economic competitiveness and growth (Dockery et al., 2021; Navy et al., 2020; Shin et al., 2018). A workforce with high science, technology, engineering, and mathematics (STEM) capacity is expected to enhance the productivity of many sectors in the industries for continuous economic growth and success (Dockery et al., 2021; Warne et al., 2019). Therefore, professions in STEM fields are constantly in great demand because it is expected to sustain a nation's development (Chachashvili-Bolotin et al., 2016; Razali et al., 2018). However, the shortage of competent STEM workers has resulted in many unfilled positions in the STEM industries across the globe (Baran et al., 2016; Mahmud et al., 2018; Warne et al., 2019). The worldwide issue has raised concerns if the respective education systems are able to prepare students for STEM careers (Ali et al., 2021; Christensen et al., 2014; Li et al., 2021).

According to the World Economic Forum (2016), education systems in many countries are in urgent need to increase the number of graduates in the fields of STEM. By 2050, Malaysia will need eight million STEM workers (Academy of Sciences Malaysia [ASM], 2017). Reports also revealed that

Malaysia will require more than one million science and technology human capital in view of the emergence of innovative sectors (ASM, 2015; Chin, 2017). Gehrau et al. (2016) also reported that there is a high demand for qualified STEM workforce for the current and future workforce, yet the young generation tends to turn away from choosing a career in STEM fields. According to Meng et al. (2014), the waning number of students in the STEM stream does not only signify a lagging education system in Malaysia, but will also affect the growth of the STEM industries in the country. The country's development will most likely reach stagnation if the current worrying issue is not addressed urgently with effective measures (ASM, 2015).

Integrating STEM into the academic settings can help to build an innovative STEM workforce to overcome the challenge in the industries (Navy et al., 2020). In the effort to ensure the supply of talents in the STEM workforce, Malaysia had implemented the Science to Arts 60:40 Policy since the 1970s to increase the ratio of science to arts students in Malaysia (Shahali, Ismail, & Halim, 2017). However, Malaysia requires a more effective curriculum to fill the vacancies in the STEM labour pool by attracting more students to learn STEM. In the latest national curriculum, STEM subjects have been introduced to all upper secondary school (equivalent to high school) students in Malaysia since 2017 to prepare them for STEM careers (ASM, 2017; Bahagian Pembangunan Kurikulum (Curriculum Development Division, 2016b; Chong, 2019). This is because the knowledge required in pursuit of STEM careers will be primarily recruited from STEM subjects students learn in school (Ali et al., 2021). It is also believed that encouraging adolescents to develop their career interest in

STEM at the secondary school level would increase their momentum in choosing STEM careers (Razali et al., 2018; Wang & Degol, 2017).

Consequently, many researchers have attempted to identify the factors that influence students' career choices. Among the factors were attitude (Ambad & Damit, 2016; Mohd, et al., 2010), subjective norms (Hoag et al., 2017; Wahid et al., 2018) and perceived behavioural control (Ambad & Damit, 2016; Halim, Rahman, Ramli, & Mohtar, 2018). These factors echo the constructs in the theory of planned behaviour (TPB) namely attitude, subjective norms, and perceived behavioural control as the predictors of behavioural intention (Ajzen, 1991).

In addition to the antecedents in the TPB, financial reward is also one of the most popular factors in the discussions of students' career choices (Ahmad et al., 2015; Sugahara & Boland, 2009). Besides, students' behaviour is often related to the influence of the media in recent years. Thus, there is an increase of literature that examines the influence of media on students' career choices, for instance Saleem et al. (2014), Gehrau et al. (2016), Sharma (2015) and Hoag et al. (2017). Interest is also frequently mentioned in past research related to career choices. Previous studies that included career interest are such as Ashari et al. (2019), Murcia et al. (2020) and Sadler et al. (2012). Therefore, the research objectives are to (a) develop a model to predict antecedents that influence students' STEM career choices, (b) examine the mediators in the model, and (c) test whether streams of study act as the moderator between STEM and non-STEM students.

1.2 The Key Concepts

The impetus of this study is to offer a comprehensive understanding on factors influencing secondary school students' STEM career choices in Malaysia. A detailed explanation on the background of the study will be provided in the subsequent sections in this chapter. This will help the readers to grasp the key concepts and comprehend the contexts that scaffold the thesis.

1.2.1 STEM Education for STEM Workforce

STEM refers to the discipline of science, technology, engineering, and mathematics (Chia & Maat, 2018). According to Bahrum et al. (2017), the acronym became prevalent in the 1990s in the United States through national policies to popularise STEM. It was noted that there is no standard definition for STEM, thus it is often defined based on the needs in each respective context (Chong, 2019; Kelley & Knowles, 2016). In Malaysia, STEM was officially used by the Ministry of Education (MOE) in its Malaysia Education Blueprint (2013-2025) (MOE, 2013).

According to Halim, Rahman, Ramli, and Mohtar (2018), STEM careers can be classified into STEM professionals and STEM associate professionals. Examples of STEM professionals include engineers, biologists, and architects. The occupations are knowledge-intensive which demand high expertise in the professions. On the other hand, STEM associate professionals are careers that require technical skills related to research and operational services. STEM associate professionals are such as technicians, supervisors and process control technicians in the logistic industries.

STEM education forms the core underpinnings of a developed nation because the strength of the STEM workforce is often used as an indicator of a country's potential (Mahmud et al., 2018; Meng et al., 2014). Ali et al. (2021) revealed that out of the 14.8 million workers in Malaysia, an upper-middle-income country, only 28% of them are in the STEM fields. Compared to high-income countries like Singapore and South Korea, there is only 25% of highly skilled workers that constitutes the workforce in Malaysia (Ali et al., 2021). While the education system is the main source of supplying STEM human capital to the workforce, it was reported that Malaysian students indicated much lower interest in science and technology than students in the West. In specific, 78% European students and 87% United States students were interested in scientific inventions and discoveries, while only 44.9% Malaysian students were interested in them (Zhongming et al., 2016, as cited in Ali et al., 2021). These figures may be the contributing factors of why Malaysia remains a developing nation.

Effective STEM education is vital to produce the human capital for STEM (Ali et al., 2021; Mohtar et al., 2019). Indeed, STEM education has been contemplated in advanced countries like the United States, China, and South Korea (Bahrum et al. 2017; Baran et al., 2016). However, STEM is still in its infancy in Malaysia (Ali et al., 2021; Mahmud et al., 2018). Razali et al. (2020) indicated that STEM education plays a pivotal role to the STEM workforce in

Malaysia because STEM education is recognised as a key driver that will help Malaysia to achieve its aspiration to develop into an advanced country. The Malaysian MOE (2013) emphasised in its education blueprint that the reinforcement of STEM education in the country will help to promote students' attitude, interest, and career aspiration in STEM. Meng et al. (2014) also highlighted that Malaysia needs STEM talents who are highly skilled so that the country can compete in the global labour force.

One of the most urgent challenges that hinders the STEM education system and STEM workforce is the constant decreasing student enrolment to the STEM stream (Mahmud et al., 2018; Meng et al., 2014). Hence, the Malaysian government has initiated a new curriculum nationwide to promote STEM career awareness. In fact, the Malaysian education system is centralised whereby all schools despite regions and states use a parallel curriculum (Ali et al., 2021). In order to establish a STEM-driven economy, Malaysia is required to revamp its education system to sustain a strong value chain from the education system to the STEM workforce (Ali et al., 2021).

Towards the end of the STEM-oriented curriculum, students are expected to contribute to the development of the country's STEM workforce by applying STEM knowledge and skills. Creating STEM awareness among students at schools will help the students to have better ideas about the career opportunities in STEM (Chong, 2019). This means early exposure to STEM among students via the STEM curriculum is anticipated to draw attention to STEM and bring about optimistic outcomes to STEM development in Malaysia (Razali et al., 2020).

The main purpose of Malaysia STEM education is to produce STEM talents who will be able to fill STEM vacancies and to apply STEM skills to solve real world problems (Bahrum et al., 2017). In discussion of STEM in the context of Malaysia, it is also important to understand the formation and revamp of its education system which aimed to reinstate the importance of STEM. The subsequent section of this chapter will elaborate on the reformation of the STEM education in Malaysia.

1.2.2 STEM Reformation

On 18 Nov 2019, the Malaysian MOE officially announced that the arts and science streams will be reformed from 2020 onwards (ASM, 2017; MOE, 2013; Mokhtar, 2019). An official letter on the changes had been circulated to all education departments nationwide in 2019 to inform the authorities and schools on the adjustments in STEM pedagogy, streaming system, and assessment in tandem with the implementation of Kurikulum Standard Sekolah Menengah (Secondary School Standard Curriculum, KSSM) (Mohktar, 2019; Senin, 2019).

Figure 1.1 shows the development of the STEM stream in the Malaysian education system. The reformation of the education system in Malaysia is one of the major initiatives instigated in the country to overcome STEM challenges. In the old curriculum Kurikulum Bersepadu Sekolah Menengah (Integrated

Secondary School Curriculum, KBSM), science and arts were mutually exclusive, and sciences were only meant for students in the science stream. Later in the new curriculum, STEM subjects have been made available for all students in the upper secondary schools, and the old science and arts streaming system was replaced by STEM and non-STEM (Curriculum Development Division, 2016a).

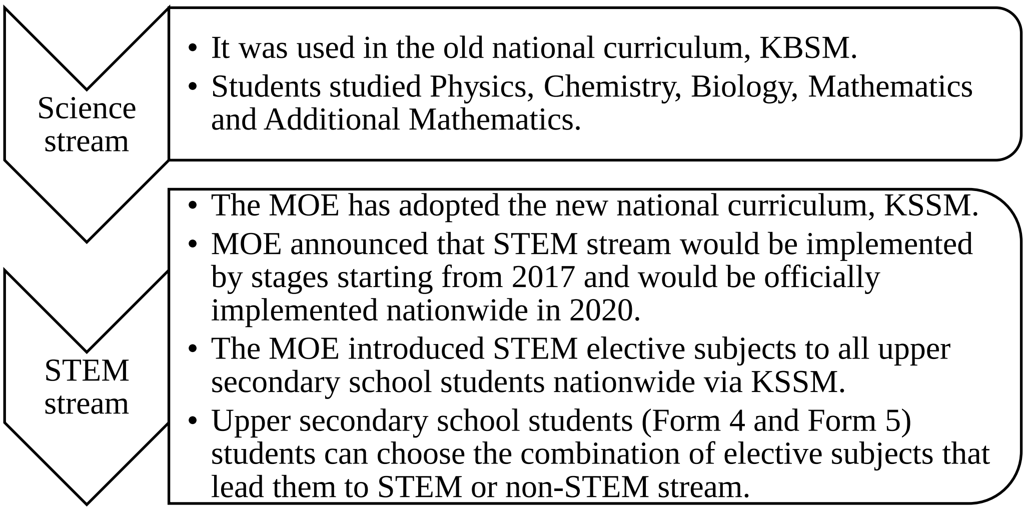


Figure 1.1: Reformation from Science to STEM Stream in Malaysia

As KSSM substituted KBSM in the Malaysian secondary education system, STEM electives subjects have been introduced to the curriculum at the upper secondary school level (Ali et al., 2021; Mohtar et al., 2019; Senin, 2019). Under the KSSM, students are provided the chance to decide the stream of study by selecting subjects they like upon their enrolment in Form Four (equivalent to Year 10) (Ali et al., 2021; Chong, 2019; Shahali, Ismail, & Halim, 2017). As such, STEM is no longer exclusive for students who opt to learn sciences, but also made available for students who major in humanities and arts. This means both STEM and non-STEM students are given the chance to learn STEM in which students who opt for non-STEM stream can also choose to register one STEM subject at the upper secondary level (Curriculum Development Division, 2016a, 2016b; Mokhtar, 2019). Meanwhile, students who decide to enrol in the STEM stream will learn more advanced STEM theories and technical skills (Ali et al., 2021; Chong, 2019).

In view of the implementation of KSSM, there will be a great difference in students' exposure, experiences and opportunities particularly in STEM. This will lead to shifts in perception in terms of how students are prepared for STEM careers under the new national curriculum. STEM reformation in Malaysia is indeed a major move to revamp its entire STEM system which requires a fairly long period to acclimatise to the actual STEM scenario, but this is not surprising. STEM education in developed countries like the United States are comparatively more mature than Malaysia. Despite that, promoting middle school students' interest and attitude towards pursuing STEM careers has remained one of the pressing educational issues in the United States (Warne et al., 2019; Wyss et al., 2012). Wyss et al. (2012) pointed out that despite STEM literacy in the United States, adolescents may still lack STEM career awareness and exposure in which media could be an effective channel to increase their interest, attitude and perceived ability for STEM careers. This is supported by Levine and Aley (2020) that media introduce adolescents to prospective careers which they did not know as the internet provides them limitless access and opportunities for information seeking. Steinke et al. (2022) also noted that student perception towards STEM could also be improved via the internet and digital media such as videos, YouTube and Facebook.

In Indonesia, a developing country, financial reward has been increased to attract more talents to join STEM fields in order to establish competitiveness of the country (Shin et al., 2018). Shin et al. (2018) believed that government investment in terms of financial reward can encourage students to develop interest in STEM, thus choosing a career in STEM fields. Nonetheless, Shin et al. (2018) also suggested that parental support remained an important factor that influences students' STEM career choice. However, Li et al. (2021) warned that teachers and parents may no longer be the sole source of career guidance for high school students in Taiwan. This is because students' interest and attitude are associated with information they received from television and the internet (Li et al., 2021).

Considering the STEM scenarios in other educational contexts, it is crucial for policymakers, educators and researchers to contemplate how students are geared towards the STEM careers in tandem with STEM reformation in Malaysia. It was observed that these empirical studies have not reached a consensus on the theoretical foundation for research in students' STEM career choices. However, some common aspects in discussion include attitude, social influence, perceived ability, media exposure, interest, and financial reward which show similarities to existing theories such as TPB and social cognitive career theory.

1.2.3 Streams of Study: STEM and Non-STEM

Alongside the implementation of KSSM, the science and arts streams were abolished in the new curriculum to emphasise STEM components as highlighted in the Malaysian Education Blueprint (MOE, 2013). However, there is still some form of streaming because students are required to choose elective subjects in the upper secondary school based on a list of packages formulated. The schools are given autonomy to offer elective subjects based on the resources and facilities available in each respective school (Mokhtar, 2019).

Starting in 2020, all upper secondary school students in Malaysia are required to learn a combination of subjects that consists of the core subjects, compulsory subjects and elective subjects (Curriculum Development Division, 2016a; Mokhtar, 2019). Core subjects are mandatory subjects that must be included in the education for all students in Malaysia. These subjects include Bahasa Malaysia (the national language of Malaysia), English, Science, Mathematics, History, and Islamic or Moral Studies (Shahali, Ismail, & Halim, 2017; Mokhtar, 2019). Compulsory subjects refer to Physical and Health Education which are meant for all students under the KSSM, excluding those from private schools.

Both STEM and non-STEM students are required to learn core and compulsory subjects (Mokhtar, 2019; Senin, 2019). This suggests that the distinct difference between the STEM and non-STEM streams is decided by the elective subjects. To draw a clearer depiction of the differences between the two streams of study, Table 1.1 presents the primary features of the STEM stream and non-STEM stream.

Table 1.1: The primary features of STEM stream and non-STEM stream

STEM Stream	Non-STEM Stream
There are three options under the STEM packages: i) Option 1: To take all the pure science subjects (Physics, Chemistry, Biology and Additional Mathematic). ii) Option 2: To take any of the two pure science subjects, with Mathematics and/or a minimum of one applied sciences and technology subject, or non-STEM elective subject. iii) Option 3: To take at least two STEM elective subjects in applied science and technology, or any one vocational subject. Note: • Students taking up any of the two pure science subjects (Physics, Chemistry, Biology) do not need to learn Science under the core subjects list. • STEM also include 22 vocational subjects, and 12 applied sciences and technology subjects. • Examples of vocational subjects: Interior Decorating, Fashion Design Domestic Pipe Works, and Food Processing. • Examples of applied sciences and technology subjects: Agriculture, Technical Graphic Communication, and Computer Science.	Non-STEM (Humanities and Arts, Languages, and Islamic Studies) package: i) A combination of elective subjects comprises those under the Elective Language groups, Islamic Studies, Humanities and Arts and/or one STEM elective subject (excluding vocational electives). Note: • There are 11 subjects in the Languages package. For instance, Chinese, Tamil, Arabic, and German. • There are 13 subjects in the Islamic Studies package. For instance, Syariah Islamiah, Tasawur Islam, and Hifz Quran.

Sources: Curriculum Development Division (2016b), Mohktar (2019), Senin (2019), and Shahali, Ismail, and Halim (2017).

Table 1.2 shows the subject combinations (also known as packages) for STEM stream students, whereas Table 1.3 presents the examples of packages for students from the non-STEM stream.

Table 1.2: The Subject Combinations (Packages) for STEM Stream

Core subjects	Compulsory Subjects	Elective subjects
Example 1		
Bahasa Malaysia English Language Mathematics History Islamic/ Moral Studies	Physical Education Health Education	Physics Chemistry Biology Additional Mathematics
Example 2		
Core subjects	Compulsory Subjects	Elective subjects
Bahasa Malaysia English Language Mathematics History Islamic/ Moral Studies	Physical Education Health Education	Computer Science Invention Technical Graphic Communication

Sources. Curriculum Development Division (2016b) and Senin (2019).

Table 1.3: The Subject Combinations (Packages) for Non-STEM Stream

Core subjects	Compulsory Subjects	Elective subjects
Example 1		
Bahasa Malaysia English Language Mathematics History Science	Physical Education Health Education	Arabic Al-Quran & As-Sunnah Education Syariah Islamiah Education
Example 2		
Core subjects	Compulsory Subjects	Elective subjects
Bahasa Malaysia English Language Mathematics History Science	Physical Education Health Education	German Language Business Studies Computer Science

Sources: Curriculum Development Division (2016b) and Senin (2019).

According to Mokhtar (2019), the subjects were designed based on industry standards together with local and international professional and certification bodies. Hence, the new curriculum in Malaysia does not only allow students to pursue subjects they like, but also trains the anticipated human capital for STEM careers (Mokhtar, 2019; Senin, 2019). This means that the KSSM will prepare the students for STEM career pathways starting from schools by facilitating students to obtain qualifications pertaining to STEM fields (Curriculum Development Division, 2016a; MOE, 2013; Mokhtar, 2019).

In view of the streaming system, more attention should be given to differences in STEM and non-STEM students' career choices. As suggested in Avargil et al. (2020) and Xu (2013), students' career choices could vary according to the values held by the discipline they are attached to. For instance, salary and contents of work are among the shared values within the cohort they belong to (Avargil et al., 2020). In the same vein, it was noted that students from the same profession value profile made similar career decisions (Guo et al., 2018). This is consistent with Ertl and Hartmann's (2019) report which revealed that STEM and non-STEM students' interest and career choice were indeed different. In the context of the present study, students are streamed into either STEM or non-STEM stream. The two groups which may hold different values. These empirical findings in past research may suggest the importance to focus on how students career choices would react differently based on the respective stream of study.

1.3 Problem Statement

Malaysia needs 60% of students at the secondary and tertiary levels to pursue STEM to meet industrial needs and support the country's socio-economic developments (ASM, 2015, 2017; MOE, 2013; Yeap, 2017). Unfortunately, students' inclination to pursue STEM has been on a constant drop (ASM, 2017;

Halim, Rahman, Zamri, & Mohtar, 2018). It was reported that Malaysia only had 48% of STEM students in 2010, and it dropped to 44% in 2019 (Educational Planning and Research Division, 2019; MOE, 2013). The declining numbers of students enrolling in the STEM stream has created great concerns in the country (Meng et al., 2014; Mohtar et al., 2019). If this issue is not appropriately addressed to reverse the present trend, Malaysia will not be able to supply the much-needed talents to the STEM-oriented workforce (ASM, 2015, 2017). Malaysia will face a deficiency of human capital in STEM-related fields because the fading numbers of qualified STEM workers contradicting the country's need will threaten its development (Ali et al., 2021; Nasa & Anwar, 2016).

This probes critical concerns whether Malaysia can meet the required STEM human capital through a pipeline that can supply sufficient talents to the STEM workforce. The unfulfilled composition of the STEM workforce in Malaysia could be due to the leaky pipeline from the education system to the workforce (Ali et al., 2018). The leakage along the STEM talent supply chain from the education system to the workforce in Malaysia has been identified to be the key that led to the challenges in STEM (MOE, 2013; Regan & DeWitt, 2015; Shahali, Halim, Rasul, Osman, & Zulkifeli, 2017). This phenomenon has also raised concerns about the compatibility between the existing education system and the policy in producing sufficient STEM graduates.

In view of this, the recent education policies and curricula have transformed to keep the Malaysian education system on par with international standards as well as the national goals and industrial needs in STEM (Razali et al., 2020; Shahali, Halim, Rasul, Osman, & Zulkifeli, 2017). The urgency to fill the vacancies in the STEM labour pool indicates the necessity to prioritise how to bridge the gaps between the education system and actual workforce through further research (Mohtar et al., 2019). It is important to identify the gaps by addressing the factors that influence students to choose STEM careers and investigate the prospective measures that can be implemented to attract more students to the fields of STEM. Therefore, more efforts have been called upon to promote students' participation in STEM to avoid worsening the situation. Instilling STEM literacy and skills among students has thus become one of the most pivotal initiatives in overcoming the challenge (Ali et al., 2021; Meng et al., 2014).

Nonetheless, there are extremely limited studies that focus on students' career choices in STEM, particularly in Malaysia where STEM talents are in critical demand. Several researchers have also pointed out that although the Malaysian government has implemented tremendous effort to incorporate STEM into its education system, there is inadequate research addressing the career issues related to STEM education in the current context (Ali et al., 2021; Jayarajah et al., 2014). Wang and Degol (2013) suggested that factors influencing career choices among secondary school students needs to be investigated because career choices are highly individualised.

The extant literature discussed career choices include a wide spectrum of variables. Among the popular variables in discussions were attitude (Ambad & Damit, 2016; Mohd et al., 2010), subjective norms (Mohd et al., 2010; Wahid et al., 2018), and perceived behavioural control (Ambad & Damit, 2016) which are reflected in the TPB by Ajzen (1991). Furthermore, the influence of media exposure has also been related to students' behaviour and career choices (Hoag et al., 2017; Sharma, 2015). Financial reward (Ahmad et al., 2015; Sugahara & Boland, 2009) and career interest (Ashari et al., 2019; Sadler et al., 2012) have also been frequently mentioned in literature related to career choices.

Moreover, the TPB and social cognitive career theory were among the most popular theories used in career choice research. Though social cognitive career theory was vastly used in career choice research, particularly in STEM (Castellanos, 2018; Li et al., 2021; Murcia et al., 2020; Shin et al., 2018), very little research was conducted in the Malaysian STEM context. Based on the review of literature, it was also noticed that there were some past studies that used the TPB to discuss career choices among adults in disciplines such as entrepreneurship (Cano & Tabares, 2017) and accounting (Wen et al., 2018), but there is hardly any literature related to STEM career choices using the TPB. Hence, there lacks a research-validated framework that describes students' career choice intention in STEM in Malaysian context. This implies the need to specify a comprehensive and up-to-date research framework that is apt to explain students' career choices and represent the STEM scenario in the current education system. Considering the critical STEM scenario in Malaysia, it raised the question as to whether the aforementioned variables and the TPB are apt to explain the factors that influence students' intention to choose a career in STEM. Through this study, the findings will provide valuable complementary insights that help generalise the TPB in career choice and its application to students'

STEM pathways.

Overall, it is imperative to identify the factors that influence students' STEM careers choice intention for the sustainability of STEM fields. The identified factors can also be referred to as the criteria to recruit students into STEM careers. Various theoretical models from multiple fields of research have been adopted and adapted to study career choices in STEM (Halim, Rahman, Ramli, & Mohtar, 2018; Razali et al., 2020). Hence, there is a need to specify a research model that can effectively predict students' STEM career choices. Besides, the existing models used to examine career choices among secondary school students need to be revisited because the exposure, opportunity and immersion that the current students receive are different from the past. It is essential to provide a more converged and up-to-date research framework that is apt to explain students' career choices in STEM and to represent the scenario in the current world.

1.4 Research Objectives and Research Questions

The main purpose of this study is to develop a model that predicts career choice intention among STEM and non-STEM students through TPB. This objective is driven by the prior studies in the literature which have discussed the antecedents that influence career choices among students. Among the popular antecedents in discussions were the key factors in the TPB (perceived behavioural control, attitude towards career choice, subjective norms), as well as financial reward, media exposure and career interest. Therefore, this study hypothesised the direct and indirect effects of the causal relationships between the aforementioned antecedents and career choice intention among STEM and non-STEM students, with TPB as the theoretical foundation of the proposed model. As a result, this study is underpinned by the research objectives as listed below:

Research Objectives

i) To develop a model to predict antecedents (perceived behavioural control, attitude towards career choice, subjective norms, financial reward, media exposure and career interest) that influence secondary school students' intention to choose a career in STEM.

ii) To examine the role of mediators (attitude towards career choice and career interest) in the proposed model for secondary school students' intention to choose a career in STEM.

iii) To test whether secondary school students' streams of study (STEM and non-STEM) act as the moderator for their intention to choose a career in STEM.

The research questions of the study were developed based on the research objectives as listed above:

Research Questions

i) Are there significant influences of the proposed antecedents (perceived behavioural control, attitude towards career choice, subjective norms, financial reward, media exposure and career interest) on secondary school students' intention to choose a career in STEM?

ii) Do attitude towards career choice and career interest significantly mediate the proposed model for secondary school students' intention to choose a career in STEM?

iii) Do secondary school students' streams of study (STEM and non-STEM) act as a moderator for their intention to choose a career in STEM?

1.5 Research Hypotheses

Aligned with the objectives in this study, the research hypotheses were formulated as listed below:

Research Objective 1 (H1 – H13)

H1: Perceived behavioural control has a significant influence on career interest.

H2: Perceived behavioural control has a significant influence on career choice intention.

H3: Attitude towards career choice has a significant influence on career interest.

H4: Attitude towards career choice has a significant influence on career choice intention.

H5: Subjective norms have a significant influence on career interest.

H6: Subjective norms have a significant influence on career choice intention.

H7: Subjective norms have a significant influence on attitude towards career choice.

H8: Media exposure has a significant influence on career interest.

H9: Media exposure has a significant influence on career choice intention.

H10: Media exposure has a significant influence on attitude towards career choice.

H11: Financial reward has a significant influence on career interest.

H12: Financial reward has a significant influence on career choice intention.

H13: Career interest has a significant influence on career choice intention.

Research Objective 2 (H14 – H22)

H14: Attitude towards career choice mediates the influence of subjective norms on career interest.

H15: Attitude towards career choice mediates the influence of subjective norms on career choice intention.

H16: Attitude towards career choice mediates the influence of media exposure and career interest.

H17: Attitude towards career choice mediates the influence of media exposure and career choice intention.

H18: Career interest mediates the influence of perceived behavioural control on career choice intention.

H19: Career interest mediates the influence of attitude towards career choice on career choice intention.

H20: Career interest mediates the influence of subjective norms on career choice intention.

H21: Career interest mediates the influence of media exposure on career choice intention.

H22: Career interest mediates the influence of financial reward on career choice intention.

Research Objective 3 (H23)

H23: The streams of study (STEM and non-STEM) moderate students' career choice intention in STEM.

1.6 Scope of the Study

Align with the research objectives, a quantitative approach was employed to investigate the research hypotheses of the proposed model to explain secondary school students' career choices in STEM. According to Gay et al. (2012), it is crucial to define the research boundaries by specifying a population for generalisability of the research findings. Since students' STEM career choices is an issue that concerns the education system and STEM workforce nationwide, the respondents were Form Four students who were under the KSSM (typically 16 years old) from Malaysia. Data were collected from secondary schools the 13 states in Peninsular Malaysia, namely Selangor, Johor, Negeri Sembilan, Melaka, Perak, Kedah, Pulau Pinang, Perlis, Kelantan, Pahang, Terengganu, as well as the Federal States of Kuala Lumpur and Putrajaya.

1.7 Significance of the Study

The overarching goal of this study is to create a well-defined research model with complementary evidence in explaining the antecedents that influence secondary school students' career choices in STEM. This study is significant because the examination of students' STEM career choices can assist in addressing the critical gaps, and identifying the key factors that are crucial for the development and planning of STEM initiatives in Malaysia. The results of this study would contribute to both theoretical and practical implications by providing empirical explanation to students' career choices in STEM. The research outcomes would be useful for the MOE, policy makers, educators, researchers and stakeholders to better prepare effective approaches to produce the desired STEM workforce and overcome waning numbers of STEM students in Malaysia.

From a theoretical perspective, this study presents the applicability of the TPB in influencing secondary school students' career choice intention in STEM. This research validates and explains the antecedents that affect students' STEM career choice intention via the salient factors in TPB (perceived behavioural control, attitude towards career choice and subjective norms), with the integration of financial reward, media exposure and career interest that would offer additional insights into career choices among STEM and non-STEM students. By doing so, a comprehensive research model to predict students' career choice intention in STEM will be yielded based on the data collected in this study. Hence, the findings from this study can add to the limited literature on STEM career choices in Malaysia.

It is also anticipated that the findings of this study would benefit researchers by providing useful information and research materials for future studies. It is hoped that this study would contribute to the body of knowledge while discussing students' career choices in STEM in Malaysia, as well as in other contexts. This would contribute to the expansion of literature in the related fields through the addition of valuable findings to the existing knowledge of students' career choices in STEM. It would also enable the researchers to further explore this field of study, create more research opportunities, and improve the available research materials to polish using the reported research outcomes from this study.

In regards of practical significance, diagnosing the salient factors that influence the secondary school students' career choices in Malaysia will offer meaningful data and facts about the secondary students' STEM career choices who are under the support of the present education system. The findings could be assimilated into the development and planning of STEM curricula and initiatives by considering how these factors can influence their career choices. This is important for improvement of policies as much capital and effort have been invested in attempting to produce adequate STEM talents for the workforce. In particular, the findings would assist the educators and policy makers to identify the keys that drive students towards STEM careers, thus tailoring the curricula contents based on the research findings to promote STEM among students more effectively.

Besides, the relations and roles among the variables may be acknowledged and taken into consideration for theoretical and practical implications. As it is necessary to prioritise how to bridge the gaps between the education system and actual workforce, the empirical findings from this study would inform the stakeholders concerning the current STEM phenomenon from students' perspectives. It is important to identify the gaps by addressing the factors that influence students to choose STEM careers, and plan for strategic solutions that can be implemented to attract more students to the fields of STEM. As career aspirations begin to develop during upper secondary school years, it is also an advantage for students to be aware of the factors that will facilitate them to prepare themselves for future pursuits as early as possible (Rozek et al., 2017). According to Razali et al. (2020), this will help students to attain STEM career aspirations so that they are more motivated in learning. As such, the findings of study may be useful for the pertinent stakeholders including the MOE, policy makers, school governors, educators, teachers and students to better understand the current scenario in support of human capital development in STEM.

1.8 Definition of Terms

The key variables used in this study are defined in this section for conceptual clarity to provide a coherent interpretation of the concepts used throughout this thesis. Below are the conceptual and operational definitions for the variables which were investigated in this study to explore the factors that influence the secondary school students' career choices in STEM.

1.8.1 Perceived Behavioural Control

According to Ajzen (1991), perceived behavioural control refers to the extent of perceived ease or difficulty of performing a certain behaviour, as well as an individual's ability and control over a particular behaviour based on the individual's experience and anticipated challenges and obstacles (Ajzen, 1991; Mishkin et al., 2016; Wen et al., 2018). Ajzen (1991) also mentioned that control beliefs which constitute the basis of perceived behavioural control explain the presence of factors that facilitate or hinder the occurrence of certain behaviour. Besides, it was also noted by Sieger and Monsen (2015) that perceived behavioural control in the TPB comprises two components, namely self-efficacy and controllability which are mutually supportive. In this study, perceived behavioural control refers to a secondary school student's self-efficacy (confidence, perceived ability and perceived ease or difficulty) and controllability refers to their choice of career in STEM.

1.8.2 Attitude Towards Career Choice

Attitude is the degree to which an individual reflects a favourable or unfavourable evaluation towards performing a certain behaviour (Ajzen, 1991; Kyle et al., 2014; Mishkin et al., 2016). According to Ajzen (1991), attitude is guided by behavioural beliefs in which the expected consequences of a particular behaviour are taken into consideration. In this study, attitude is termed as attitude towards career choice which refers to a secondary school student's favourable or unfavourable evaluation towards choosing a career in STEM.

1.8.3 Subjective Norms

Subjective norms refer to a social factor-oriented term which is defined as an individual’s perceived social pressure from important others to perform or avoid a certain behaviour (Ajzen, 1991, 2002b; Mishkin et al., 2016). Subjective norms are derived from normative beliefs which are related to the normative expectations of other people (Ajzen, 1991). These key individuals of influence such as teachers and parents are influential in affecting student’s STEM choice (Regan & Dewitt, 2015). In this study, subjective norms indicate the social pressure and influence received from important persons (teachers, parents and peers) by a secondary school student whether to choose a career in STEM or not.

1.8.4 Media Exposure

Media exposure is defined as the opportunities for a reader, viewer or listener to receive information from any type of media that help shape the person’s beliefs (Qader & Zainuddin, 2011). Some instances of media include television, newspapers and social media, books, radio and the internet (Halim, Rahman, Zamri, & Mohtar, 2018; Saleem et al., 2014; Sharma, 2015). Potter (2012) also explained that media exposure can exert effects on an individual including his or her belief and behaviour. In this study, media exposure refers to the opportunities for a secondary school student to attain information from diverse types of media that could form their belief towards career choices in STEM.

1.8.5 Financial Reward

Based on Ahmad et al. (2015), financial reward is an expected outcome or a goal that employees strive for. Meanwhile, Sugahara and Boland (2009) described financial reward as a form of physical benefit that influences students' career choice. Harunavamwe and Kanengoni (2013) explained that financial reward includes monetary incentive, pay, commission, bonus and allowance that motivate people to perform better at work. According to Kong et al. (2020), financial reward comprises bonus, compensation, salary, and other economic motivators. In this study, financial reward refers to a secondary school student's expected monetary outcome towards their career choice in STEM.

1.8.6 Career Interest

According to Silvia (2006) and Murcia et al. (2020), interest functions as an emotional approach that competes against avoidance to do something. It also helps to support an individual's development in the things needed and commitment to activities within their grasp. Vocational interest also refers to the pattern of likes, dislikes, and indifferences regarding any activities that are related careers and occupations (Lent et al., 1994; Halim, Rahman, Zamri, & Mohtar, 2018). Lent et al. (1994) also suggested that interests are likely to lead to the intention to engage in a certain behaviour (Bonitz et al., 2010). Therefore, in this study, career interest refers to a secondary school student's emotional approach of likes, dislikes, and indifferences towards STEM careers.

1.8.7 Career Choice Intention

Ajzen (1991) proposed that intention is an indication of how hard an individual is willing to try, and how much effort he or she plans to perform the behaviour. Ajzen (1991) also suggested that intention is the behavioural disposition and immediate predictor that leads to a particular behaviour. Attitude, subjective norms and perceived behavioural control function independently to form behavioural intention, and intention is the most proximal determinant that will lead to a behaviour (Ajzen, 1991; Mohtar et al., 2019; Kyle et al., 2014). Hence, in this study, CCI refers to a secondary school student's willingness and plan to choose a career in STEM.

1.8.8 Streams of Study

In view of the official implementation of the new national curriculum KSSM in 2020 (Curriculum Development Division, 2016b), upper secondary school students in Malaysia are given the opportunities to choose the streams of study upon their enrolment at Form Four. According to the MOE, there are two streams of study in the KSSM: STEM and non-STEM. Hence, in this study, students from the STEM stream typically learn elective subjects such as Additional Mathematics, Computer Science and Physics. On the other hand, non-STEM stream students take up elective subjects in Languages, Islamic Studies and Economics.

1.9 Organisation of the Thesis

This thesis consists of five chapters: Introduction, Literature Review, Methodology, Results and Findings, and Discussions and Conclusion. Chapter 1 begins with an overview of the present study with a brief review on the research background. The key concepts investigated in this study are elaborated in detail to provide thorough background review of core issues discussed in this thesis, and to offer a clear understanding of the context of the study. The problem statement is also included in this chapter, followed by the research objectives, research questions, hypotheses, and the scope and significance of the study. The important terms are also introduced in this chapter with their respective conceptual and operational definitions.

Chapter 2 consists of the review of literature on the theoretical basis that this study is built upon. The variables and proposed relationships are also reviewed in this chapter with supporting evidence and references from the prior research in the existing literature. Chapter 2 is concluded with the illustration and presentation of the conceptual framework of this study.

On the other hand, Chapter 3 encompasses the research design that was employed to achieve the research objectives. This chapter entails the location of the study, the population, and the selection of samples. This is followed by detailed descriptions on the research instrument, ethical considerations, data collection and a brief introduction to the data analysis technique used in the study.

Chapter 4 begins with a report on the descriptive and preliminary statistical analyses conducted prior to inferential analyses. In this chapter, the respondents' profiles are also described with supporting data to offer the audience a better understanding of demographic information of the participants of the present study. The results from the descriptive and inferential analyses are presented systematically using tables, figures and illustrations generated from statistical tools.

In Chapter 5, it offers a summary of the results generated from the previous chapter. The results drawn from Chapter 4 are also discussed in Chapter 5 to answer the research questions aligned with the objectives. Theoretical and practical implications elicited from the research findings and discussions are also elaborated in this chapter. Chapter 5 concludes with the limitations encountered in the present study and suggests recommendations for future research.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Chapter 2 reviews pertinent literature that addresses the topics that directly and indirectly relate to secondary school students' STEM career intention in Malaysia. This chapter begins with the review of the seminal previous studies and theories on career choices. The following section in Chapter 2 includes a review of TPB and social cognitive career theory which are the most widely used theories in career choices in the existing literature. The subsequent reviews are presented systematically according to proposed variables and research hypotheses. The following sections reviewed the literature that supported the proposed antecedents, mediators and moderator hypotheses formulated based on the research objectives. This chapter concludes with the conceptual framework derived from the review of the literature.

2.2 Review of Previous Studies

Career choice is a person's decision that will direct his or her future (Humayon et al., 2018). According to Avargil et al., (2020) and Wang et al. (2017), a career pathway to STEM is formed during high school or adolescence. It was also pointed out that students' STEM decision during high school years is beyond STEM enrolment and academic performance, whereby it also greatly affects their future interests and choices in STEM (Maltese & Tai, 2011; Muenks et al., 2020). This means that upper secondary school is a critical period which students' academic pathways and career aspirations to STEM are shaped. Echoing the aforementioned, Rozek et al. (2017) also noted that preparing students for STEM pursuits should start from the upper secondary years. At this stage, students begin to show their intention to pursue a STEM career as they are given the opportunities to choose subjects or courses they like at the upper secondary level (Wang et al., 2017). Mohd et al. (2010) also highlighted that, in Malaysia, upper secondary school students' career choice is crucial because they are expected to develop STEM skills and knowledge based on the academic contents they learn for future careers.

Previous studies related to students' career choices are presented in this section to offer an overview of the existing research in the literature consistent with the research objectives of the current study. Past studies using different theories in the investigation of STEM career choices among secondary school students were also reviewed to provide a cutting-edge perspective towards the latest trend in career choice research. Besides, this section also highlights past studies that used TPB for career choices in various educational and geographical contexts to underpin the rationale for using TPB in this study.

2.2.1 Previous Studies and Theories on Career Choices

In Wang et al. (2017), a relative cognitive strength and interest model was used to predict career choices in STEM among high school students in the

United States. This study proposed interests and abilities as the keys that form students' STEM careers pathways. Wang et al. (2017) asserted the importance of individual differences such as cognitive profiles, sociocultural factors, motivational beliefs and economic barriers in affecting students' career choices. In view of this, Wang et al. (2017) included science and mathematics abilities into cognitive profiles, to investigate how students' science/ mathematics/ verbal abilities would lead to STEM career decisions. Besides, Wang et al. (2017) also included other variables that indicated individual differences in their study, for instance, science and mathematics interest/ task value, altruism, and monetary value. Therefore, the main objective of Wang et al.'s (2017) research was to examine the influence of students' individual differences in mathematics and science on their career choices in STEM.

Align with the research aim, Wang et al. (2017) employed a person-centred approach to categorise students into separate groups according to heterogeneity in their math, science, and verbal abilities. Wang et al.'s (2017) longitudinal research involved two waves of data collection. There were a total of 1,762 respondents who completed both stages of the study, that is, at the first stage at Grade 9 and the latter stage at age 33. In sum, Wang et al. (2017) reported that individuals in the asymmetrical cognitive ability profiles (moderate-science/ moderate-mathematics/ low-verbal ability) with higher mathematics ability task values were more likely to opt for STEM careers. On the other hand, respondents who possessed symmetrical cognitive ability profiles (high abilities in science/mathematics and verbal) with higher science task value and weaker inclination towards altruism, had greater intention to choose a career in STEM.

It can be concluded from Wang et al.'s (2017) research that, while it is important to find out "what" influences students' career choices based on numerous variables, it is also imperative to understand "who" are more likely to pursue STEM careers.

Murcia et al.'s (2020) study used a qualitative approach to discover the factors influencing STEM career interests and choices among secondary school students in Western Australia. In their research, it was also noted that adolescents begin to establish beliefs and goals towards careers at secondary schools (Murcia et al., 2020). Hence, interviews in the research involved 15 lower secondary school students and 15 of their parents, as well as three career school counsellors. Social cognitive career theory developed by Lent et al. (1994) was used as the theoretical foundation to emphasise on STEM self-efficacy that affect teenage students' STEM career choices. The key drivers in social cognitive career theory include interest, and variables related to person, environment and socio-demographic characteristics. The social cognitive career theory argues that interactions between each individual variable and environmental factors can influence a person's career development (Lent et al., 1994; Murcia et al., 2020). In brief, this theory suggests that an individual develops interests based on their beliefs about their self-efficacy and the outcomes they would achieve.

One of the main purposes of Murcia et al.'s (2020) study was to investigate the influence of the learning environment on career interest and self-efficacy among students. Through social cognitive career theory, Murcia et al.'s (2020) research found that students were keen on having conversations with their parents and counsellor teachers to discuss STEM-related opportunities and experiences. Moreover, it was reported that students' self-efficacy increased as their learning environment was facilitated by influencers who could share their opinions on subject selections and career aspirations (Murcia et al., 2020). Another important finding from Murcia et al. (2020) was students' interests in pursuing STEM careers were associated with their parents' STEM-based careers. While counsellor teachers were important in providing career advice to students, parents played important roles in encouraging and supporting their interests in STEM careers. Additionally, Murcia et al. (2020) also revealed that counsellor teachers' engagement in the latest updates in STEM could offer students rich career advice and resources. When the counsellors could support students with sufficient information about career options in STEM, students were more motivated in tackling STEM challenges which would eventually encourage them to pursue STEM careers. Pertaining to the present study, it can be concluded from Murcia et al. (2020) that parents and teachers were important influencers that influence students' interests and career choices in STEM.

Similar to the present study, Blotnicky et al. (2018) investigated students' likelihood to choose a career in STEM. Blotnicky et al.'s (2018) research focused on student knowledge of science and mathematics for STEM careers, as well as their mathematics self-efficacy, career interests, grade level, and preferred career activities. Blotnicky et al. (2018) argued that incorporating the aforementioned domains in discussion of career decisions would offer a holistic perspective to predict students' likelihood in choosing STEM careers. Various measures were employed in their research to assess each proposed domain. STEM career knowledge and mathematics self-efficacy were developed to measure students' science and mathematics knowledge, and mathematics experiences. Meanwhile, students' grade levels were divided into two groups, namely Grade 7 and Grade 9. Students' preferred career activities and career interests were examined using social cognitive career theory, and Hollands' theory of career choice and development, respectively. Lastly, students' career choice intention in STEM was measured according to how likely they would choose a career in science, health, engineering, and technology disciplines.

Blotnicky et al.'s (2018) research was based in Atlantic Canada involving 1,448 middle school students who aged between 11 and 20. Overall, findings from the research showed that students generally lacked in science and mathematics knowledge required for careers in STEM. Results from regression analyses indicated that students with higher mathematics self-efficacy and STEM career knowledge possessed higher likelihood to choose a STEM career (Blotnicky et al., 2018). Besides, the research highlighted that students' interest in technical and scientific skills was a significant predictor of their intention to choose a career in STEM. This is because as compared to students who favoured careers related to practical, productive and concrete activities, students who showed greater interests in scientific and technical skills had greater intention to select STEM occupations. Thus, it can be understood from Blotnicky et al.'s (2018) research that students with higher mathematics self-efficacy, and those who were more interested in the scientific and technical skills were more likely to pursue STEM careers.

Moreover, Mohtar et al. (2019) developed a model of interest in STEM careers based on the social cognitive career theory to examine secondary school students' career interest in STEM, specifically in physical sciences and life sciences. Mohtar et al. (2019) proposed model consisted of environmental factors, self-efficacy, perceptions of STEM careers, and interests in life sciences and physical sciences careers. Environmental factors were learning experiences (activities inside and outside classrooms), social influences (parents and friends), as well as media (printed and electronic). On the other hand, self-efficacy in Mohtar et al. (2019) referred to students' self-efficacy in each individual discipline of STEM. In Mohtar et al.'s (2019) proposed model, perceptions of STEM careers indicated job prospects and skills needed in life sciences and physical sciences careers, whereas students' interests in life and physical sciences are indicated by their choice in STEM occupation.

This study was conducted in Malaysia with participation of 1,485 14-year-old students in secondary schools (Mohtar et al., 2019). Data were collected using survey questionnaires and Structural equation modelling (SEM) was used for data analyses. Generally, it was found that the hypothesised factors in Mohtar et al.'s (2019) study had significant influence on students' careers interest in physical and life sciences. Students' perceptions of the career and self-efficacy were significant factors that influenced students' career interest in life sciences. On the other hand, secondary school students' career interest in physical sciences was only determined by their self-efficacy. It was also reported in Mohtar et al., (2019) that social influences and media had significant influence on students' STEM career interests. Overall, Mohtar et al.'s (2019) successfully developed a model of STEM interest derived from the social cognitive career theory, with environmental factors, self-efficacy, and perceptions of STEM careers as the predictors that influenced career interests in physical and life sciences.

TPB was used in Wen et al. (2018) which examined factors influencing students' career intention in accounting. The research was located in China, and data were collected from undergraduate and graduate accounting students in a Chinese university. In Wen et al. (2018), students' career choice intention referred to students' preference to work in choice in either public accounting (accounting firms) or private accounting (industry, government or education institutions). Through the TPB, the factors investigated in Wen et al.'s (2018) research included compensation/perceived income, experiences, marketability, turnover, dynamic work environment, normative influence, perceived difficulty, and certification to choose a career. Control variables used in Wen et al. (2018) were academic status, gender and age.

Data in Wen et al. (2018) was collected utilising a bilingual survey questionnaire that was available in English and Chinese. The respondents of their research were randomly selected from undergraduate and graduate accounting classes at both levels, and 163 responses were collected in the classes. Data analysis was carried out using a binary logistic regression analysis to examine the factors that affect students' intention to choose careers in public accounting over private accounting. Overall, Wen et al. (2018) found that the significant factors of students' career choice intention in public accounting careers were marketability, turnover, low dynamic work environment, and perceived difficulty.

Besides, it was reported in their study that perceived income and normative influence did not have significant relationships with students' intention in public accounting careers. According to Wen et al. (2018), this research offered valuable evidence in the applicability of TPB for students' career choices. The researchers also recommended the future studies to test the predictability of TPB for students' career choices in other countries and cultures.

Another research conducted using the TPB was a retrospective research conducted in the United States by Krupat et al. (2017) to inspect the determinants linked to physicians' career choice. In this study, stereotype threat (being a woman and/or ethnic minority) was assimilated into the TPB to determine the factors that had led to physicians' decisions in pursuing a career in biomedical research (Krupat et al., 2017). Furthermore, the outcome measure was assessed by recruiting physicians who had graduated from Harvard Medical School for an average of 15 years as the respondents of the study. According to Krupat et al. (2017), this allowed the researchers to identify the extent of the respondents' commitment in their current careers (Krupat et al., 2017). The factors investigated in Krupat et al.'s (2017) study were attitude, normative influence, stereotype threat and outcome measure, whereas perceived behavioural control (an original predictor in the TPB) was exempted in this study due to technical errors.

Electronic questionnaires were used to collect data from 358 respondents in Krupat et al.'s (2017) research. Data collected from the surveys were analysed using multivariable ordinal regression and unadjusted analyses. Overall, Krupat et al. (2017) reported that the proposed variables in their study were independently linked to the physicians' current research careers. In specific, attitude and normative influence (family members, friends, and mentors) were strong predictors for physicians' choice of their current careers (Krupat et al., 2017). It was also found in Krupat et al. (2017) that women physicians who indicated more extensive research participation during medical schools showed twofold likelihood to pursue careers in biomedical research. Krupat et al. (2017) asserted that their findings were in line with the TPB, suggesting both external and internal factors could affect choice of career pathways. As suggested in Krupat et al.'s (2017) study, it can be concluded that the factors used for career choice prediction were modifiable, hence interventions could be designed based on the research findings to increase STEM careers involvement among young populations.

In Cano and Tabares (2017), Global University Entrepreneurial Spirit Students' Survey was used to describe factors that determined entrepreneurial intention among Columbian university students. The three factors discussed in Cano and Tabares (2017) were identified based on the TPB, and they were categorised into two dimensions. The fist dimension was internal dimension which consisted of perceived desirability (attitude) and perceived behavioural control. This dimension focused on students' personal motivations, self-efficacy and perceived controllability for entrepreneurial intention. On the other hand, the external dimension entailed perceived social norms which was equivalent to subjective norms in the TPB (Cano & Tabares, 2017). The external dimension encompassed three aspects, namely university, family and socio-cultural contexts.

The research involved a total of 801 students from six universities in Columbia. Cano and Tabares (2017) found that students' entrepreneurial intention was determined by their personal motivation to make their dreams true. Students also indicated greater tendency for entrepreneurial intention if they had greater autonomy to make decisions and to create something of their creative needs (Cano & Tabares, 2017). Besides, the research also suggested that Columbian students showed great intention to pursue entrepreneurship and attend entrepreneurship courses in university. Besides, Cano and Tabares (2017) also reported that students' immediate family members were most influential on their entrepreneurial intention, followed by friends and classmates. More specifically, students showed strong entrepreneurial intention when they were surrounded by an entrepreneurial family environment (Cano & Tabares, 2017).

In Malaysia, TPB was also used as a theoretical basis in the research conducted by Ambad and Damit (2016). The main objective of Ambad and Damit's (2016) research was to determine the factors influencing undergraduate students' intention in entrepreneurship pursuits in future. Through the TPB, Ambad and Damid (2016) hypothesised five factors to predict undergraduates' career choice intention in entrepreneurship. Personal attitude, perceived relational support, and perceived behavioural control were developed from the original TPB constructs, while perceived educational support and perceived structural support were added to the extended TPB in Ambad and Damit (2016). Perceived educational support was regarded as an approach that facilitated the students to be trained with entrepreneurship knowledge, whereas perceived structural support referred to entrepreneurial assistance students received from various private and public agencies in Malaysia for entrepreneurial activities (Ambad & Damit, 2016).

In line with the aim of Ambad and Damit's (2016) study, 351 undergraduates were recruited from a public university in Malaysia to examine the predictors that influence students' entrepreneurial intention. Both online and physical questionnaires were administered to students who had completed an entrepreneurship course in the university. SEM was employed to analyse the collected data using Partial Least Squares approach. Based on the results, Ambad and Damit (2016) revealed that personal attitude, perceived rational support, and perceived behavioural control were significant predictors of intention to choose an entrepreneurial career. Specifically, personal attitude was the most powerful factor that influenced students' entrepreneurial career intention. According to Ambad and Damit (2016), although the predictive power of perceived rational support and perceived behavioural control were not as strong as attitude, they also indicated valuable findings to the research. As reported in their research, the undergraduates were motivated to pursue entrepreneurship when they thought the career was easy and not too challenging. Likewise, entrepreneurship students indicated that encouragement from their family members, friends and close connections influenced their choice intention in entrepreneurial careers. It was noticed in Ambad and Damit's (2016) research that the original factors entailed in the TPB were significant predictors for students' career choice, while the additional factors were not, hence verifying the robustness of the original factors in the TPB.

Moore and Burrus (2019) employed the TPB to examine STEM career and college major choice intentions among Grade 11 and Grade 12 students. In their research, TPB was used as the theoretical basis because it has robustly justified intention as a strong predictor of actual behaviour (Moore & Burrus, 2019). Hence, the proposed predictors of career and college major choice intentions in Moore and Buurus (2019) were attitudes, subjective norms and perceived behavioural control. Additionally, their research also incorporated students' mathematics course grades and test scores, conscientiousness, social-economic status, race/ ethnicity, and interest as the controlling variables of the study. There was a total of 1,958 participants who completed the online survey (Moore & Buurus, 2019). Data were analysed using hierarchical logistic regression and confirmatory factor analyses.

Results showed that TPB was a powerful theory in predicting students' career and major choice intentions with attitude and intentions were the strongest predictors in the proposed model (Moore & Burrus 2019). It was also highlighted in their study that TPB measures added 4.0 to 4.5% in the variance explained in the model proposed by Moore and Burrus (2019). Besides, Moore and Burrus (2019) also reported that although the predictive power of attitudes and interests were slightly stronger on females as compared to males, TPB also added incremental prediction to students' STEM career and college major choices regardless of gender differences. Moore and Burrus (2019) emphasised that despite the powerful predictive ability of TPB in STEM-related choices, this theory was not given sufficient attention in STEM choices research. Therefore, Moore and Burrus (2019) claimed that it was the pioneer that successfully applied TPB for STEM choices research, and recommended researchers to consider other variables such as job salary and future studies. Moore and Burrus's (2019) research offered useful insights to the present study on the feasibility of TPB by incorporating other variables for STEM career choice research to meet the research objectives. Their research also provided valuable perspective to test differences in students' STEM choices across external and categorical variables such as students' academic and demographic background.

2.3 Theories Related to the Study

Indeed, various theories have been used in the extant literature for research related to STEM and career choices. According to the review of the literature, it was noticed that TPB (Krupat et al., 2017; Moore & Burrus, 2019; Wen et al., 2018), and social cognitive career theory (Blotnicky et al., 2018; Mohtar et al., 2019; Murcia et al., 2020) were among the most popular theories used in career choice research (Table 2.1). Hence, the two theories will be discussed in the following section to further underscore the rationale for using TPB as the theoretical foundation in this study.

Table 2.1: Previous Theories on Career Choices

Study	Theory/ Model	Objective
Wang et al. (2017)	Relative cognitive strength and interest model (On STEM career choice)	To predict career choices in STEM among high school students in the United States.
Murcia er al. (2020)	Social cognitive career theory (On STEM career choice)	To discover the factors influencing STEM career interests and choices among secondary school students in West Australia.
Blotnicky et al. (2018)		To determine school students' likelihood to choose a career in STEM in Atlantic Canada.
Mohtar et al. (2019)		To develop a model of interest in STEM careers based on the social cognitive career theory to examine secondary school students' career interest in STEM.
Wen et al. (2018)	Theory of planned behaviour (Not on STEM career choice)	To examine factors influencing students' career intention in accounting in China.
Krupat et al. (2017)		To inspect the determinants of career choice among physicians who had graduated from Harvard Medical School.
Cano and Tabares (2017)		To describe factors that determined entrepreneurial intention among Columbian university students.
Ambad and Damit (2016)		To determine the factors influencing undergraduate students' intention in entrepreneurship pursuits in future.
Moore and Burrus (2019)	Theory of planned behaviour (On STEM academic choice)	To examine STEM career and college major choice intentions among Grade 11 and Grade 12 students.

2.3.1 Social Cognitive Career Theory

Besides the TPB, social cognitive career theory is also a popular theory in recent research for career choices in various disciplines of study. This theory is rooted from Bandura's (1986) general social cognitive theory, a broader framework that is used to test psychosocial functioning. The social cognitive career theory was refined to describe behaviour related to career choices (Dutta et al., 2015; Lent et al., 1994). As compared to the TPB, social cognitive career theory is considered a relatively new theory. According to Lent et al. (2002), outcome expectations, self-efficacy beliefs, and goals are the key aspects in social cognitive career theory.

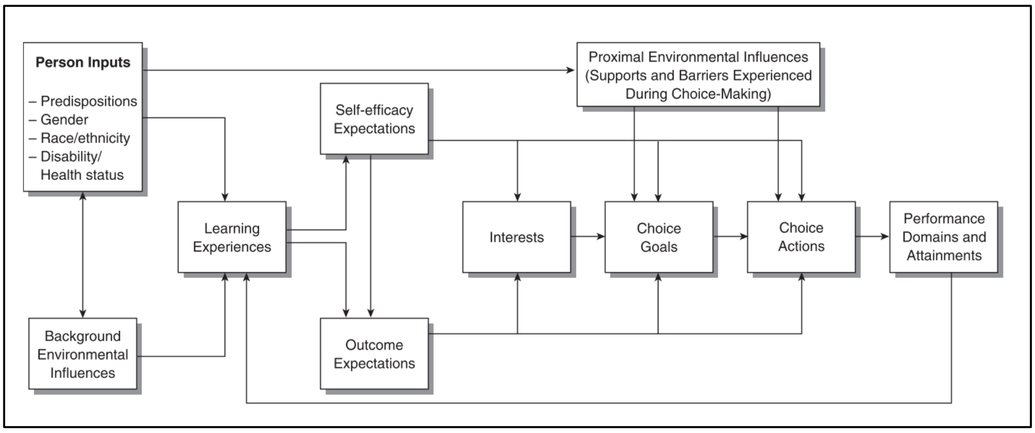


Figure 2.1: A Simplified Visual of Career Interest and Choices Development Based on Social Cognitive Career Theory (Lent et al., 2002)

The social cognitive career theory is a rather complex theory that describes the development of career-related choices and interests over time. Hence, Lent et al. (2002) simplified the theory to provide a clearer view on how the intricate relationships among the core aspects (outcome expectations, self-efficacy beliefs, and goals). As shown in Figure 2.1, the three main aspects of the social cognitive career theory are also examined with the integration of several other concepts such as abilities, interests, and personal and environmental factors (Lent et al., 2002; Regan & DeWitt, 2015).

Due to the complexity of the social cognitive career theory, it is often used to understand the development of interests and choices in academic and career, as well as how occupational success can be achieved (Lent et al., 2002; Mohtar et al., 2019). For this reason, the social cognitive career theory has been employed in many past studies to investigate the factors influencing choice of careers (Regan & DeWitt, 2015; Sahin et al., 2015). This theory is also one of the most applied theories in STEM-related contexts (Blotnicky et al., 2018; Chachashvili-Bolotin et al., 2016; Dutta et al., 2015) because it allows researchers to assess how cognition interacts with the environment for career development.

2.3.2 Theory of Planned Behaviour

TPB developed by (Ajzen, 1991) is one of the most widely used theories due to its applicability to predict future intention and behaviour across different contexts. In TPB, developed by Ajzen (1991), decision making involves a series of preludes that lead to an individual's actual execution of a particular behaviour (career choice in this study). According to Ajzen (1991), intention is the precursor of actual behaviour, thus behaviour can be predicted by determining intention using the TPB. Based on this theory in which decision-making processes are subjected to the key determinants, namely attitude toward behaviour, subjective norms, and perceived behavioural control (Ajzen, 1991; Moses et al., 2018). This means that the combination of these motivational factors constitutes an individual's intention to perform a behaviour (Ajzen, 1991; Solesvik, 2011; Zhang & Huang, 2018).

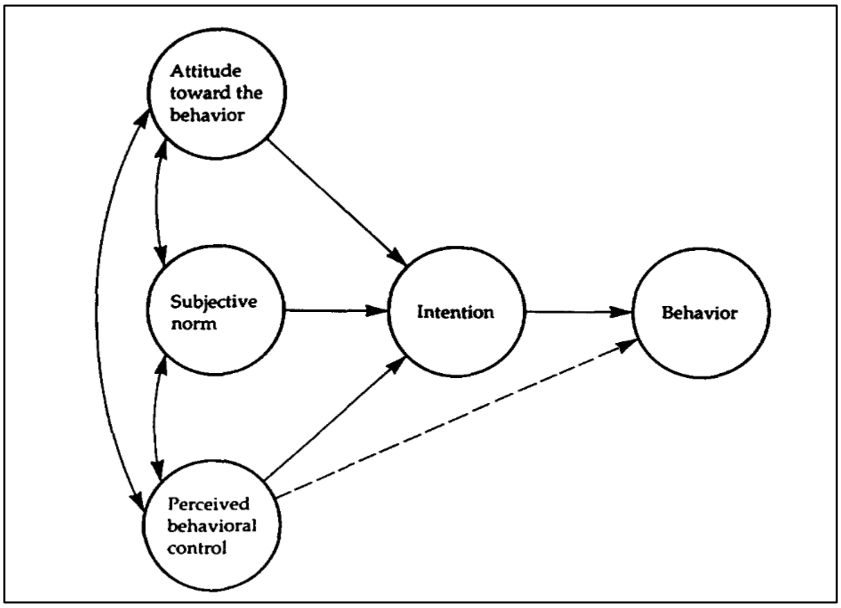


Figure 2.2: Theory of Planned Behaviour developed by Ajzen (1991)

In fact, the TPB as shown in Figure 2.2 was developed based on the theory of reasoned action which originated from social psychology. The theory of reasoned action is similar to TPB which hypotheses that behaviour is determined by intention, but is only predicted by attitude towards behaviour and subjective norms without perceived behavioural control (Ajzen, 1991; Fishbein & Ajzen, 1975; Zhang & Huang, 2018). In other words, the TPB is an extension of the theory of reasoned action. Actual behaviour can be directly predicted by intention which is determined by attitude, subjective norms and perceived behavioural control.

In particular, attitude towards behaviours denotes behavioural beliefs about the consequences towards performing certain behaviours (Ajzen, 1991; Zhang & Huang, 2018). Subjective norms refer to external referents or perceived social influences associated with normative beliefs which lead to the intention to execute a particular behaviour. Meanwhile, perceived behavioural control is influenced by an individual's control beliefs that facilitate or impede the performance of behaviour. Intention refers to how much effort an individual plans to execute a particular behaviour (Ajzen, 1991).

Based on the review of literature, TPB is recognised as a prominent theory that has been applied broadly in previous studies to investigate intentions and behaviours in various types of behaviours (Moore & Burrus, 2019). It is also a prominent theory used in the educational contexts such as technology use (Teo & Lee, 2010) and e-learning (Mohammadyari, & Singh, 2015). As reported in the past studies, the literature has consistently suggested attitude, subjective norms and perceived behavioural control to be significant factors that predict behavioural intention in the TPB. More recently, it has garnered more attention in the contexts of STEM (Lin & Williams, 2016; Moore & Burrus, 2019) and career choices (Krupat et al., 2017; Wen et al., 2018) due to its robustness in the educational research and urgent demand in these research areas. Through the TPB, attitude, subjective norms and perceived behavioural control were also found to be influential in predicting students' career choice intention (Ambad & Damit, 2016; Krupat et al., 2017).

2.4 Theoretical Framework

From the review of literature, the researcher of the present study noticed that the TPB for STEM career choice intention is extremely scarce despite its popularity in career choice research in other disciplines. This is supported by Moore and Burrus (2019) which was reportedly the first TPB-based research for

STEM-related choices among students. Moore and Burrus (2019) noted in their research that, despite the robustness and predictive power of the TPB, this theory was yet to be used to predict students' careers and academic choice in STEM.

As suggested by Moore and Burrus (2019), one of the most recognised strengths of TPB is its "ability to speak to the creation of interventions that might encourage those students who are 'on the fence' about entering into STEM fields to follow-through in choosing STEM majors and careers". While social cognitive career theory is a specific theory that is commonly used in career-related research, the TPB also recorded rich literature in career choices in various disciplines, except STEM. This raised the researcher's curiosity on the feasibility and applicability of TPB in STEM career choice, and to add to the body of knowledge regarding the predictability of TPB on students' choices in STEM.

The TPB supports this study which investigates the antecedents that are related to secondary school students' career choice intention. The TPB was used as a guide and foundation of this research as it is one of the most prominent and well-supported models in career choice and education research (Krupat et al., 2017; Kong et al., 2020; Mishkin et al., 2016; Sieger & Monsen, 2015). From the reviewed literature, it is clear that the prevalent use of the TPB is due to its feasible and sturdy structure in explanation and prediction in intention and behaviour across diverse samples and contexts.

As mentioned in Ajzen's (2002b), although the TPB is well-established in the literature, it is recommended to employ a richer conceptualisation of its framework to meet the objectives of each respective research (Sieger & Monsen, 2015). Thus, this study proposed that it is important to reconsider the factors that influence secondary school students' STEM career choices through a cutting-edge perspective to better understand the actual scenario after the implementation of the new curriculum in Malaysia. Therefore, the TPB was used as the theoretical foundation of the present study to offer a clearer view on the factors that contribute to STEM career choice intention among secondary school students who are under the latest STEM-oriented curriculum.

Besides, Wen et al. (2019) also recommended researchers to employ TPB to test whether findings generated using TPB are context specific. In the reviewed literature, the TPB was mostly studied among university students (Mishkin et al., 2016; Moore & Burrus, 2019) and adults (Krupat et al., 2017; Wen et al., 2018), and was most commonly used for career intention in entrepreneurship (Ambad & Damit, 2016; Wen et al., 2018). In view of the absence of TPB research in STEM career choices among secondary school students, this study aimed to confirm the feasibility of TPB for STEM intentions, particularly among secondary school students. This also contributes to the STEM education and career research because this is the first TPB for STEM after the implementation of the STEM-oriented KSSM curriculum.

2.5 The Proposed Variables

In this section, the proposed variables in the present study will be discussed and reviewed based on the extant literature. This is to elaborate the relevance of the predictors pertinent to the development of the research hypotheses postulated according to Objective 1. The variables reviewed in this section are perceived behavioural control, attitude towards career choice, subjective norms, media exposure, financial reward, career interest, and career choice intention.

Align with the scope and objective of the present study, intention is operationalised to career choice intention which refers to a secondary school student's willingness and plan to choose a career in STEM. As reviewed in the literature, previous studies have proposed various factors and theories to examine career intention based on the respective research purposes and contexts. Literature that supports the proposed antecedents (perceived behavioural control, attitude towards career choice, subjective norms, financial reward, media exposure, and career interest) of this study will be further discussed subsequently. The combined effect of the antecedents on career choice intention with TPB as the theoretical basis will also be tested to deliberate their influence on students' career choice intention.

2.5.1 Perceived Behavioural Control

Perceived behavioural control refers to an individual's confidence and sense of control over his or her perceived ability to conduct a behaviour (Ajzen, 1991; Wen et al., 2018). Ajzen (1991) noted that control beliefs which constitute the basis of perceived behavioural control explain the presence of factors that facilitate or impede the execution of a particular behaviour. Based on the person's experience and expected challenges, perceived behavioural control can also be defined as the extent of perceived ease or difficulty in executing, as well as the ability and control over a behaviour (Ajzen, 1991, Mishkin et al., 2016; Moses et al., 2018).

In Wen et al. (2018), perceived behavioural control is the degree to which an individual feels about the level of difficulty to take actions on the behaviour. Wen et al.'s (2018) study aimed to investigate the factors that affected students' accounting career choice intention in China explained that perceived behavioural control is determined by a student's sense of control over the choice, and his or her confidence to decide the behaviour. Likewise, Moore and Burrus (2019) explained perceived behavioural control as the degree to which a person believes in his or her capability in committing a behaviour. Using the TPB, Moore and Burrus (2019) hypothesised that perceived behavioural control had influence on STEM-related behaviour subjected to a person's beliefs such as "mathematics is too hard for me to do" and "my school does not offer calculus, so I am unable to take calculus" (p. 5).

Ajzen (2002b) argued that perceived behavioural control is an overarching construct which consists of two key components, that is, self-efficacy and controllability. Specifically, self-efficacy mainly deals with the ease or difficulty of performing a behaviour, whereas controllability entails the degree to which execution of the behaviour is up to the person. In view of this, Ajzen (2002b) emphasised that both self-efficacy and controllability are crucial control components under the perceived behavioural construct in the TPB. According to Lent et al. (2002), self-efficacy can influence goal or intention via interest due to the overlapped features of self-efficacy and perceived behavioural.

From the review of literature, there were various studies that discussed the association between perceived behavioural control and career choice. Nevertheless, the findings were inconsistent. The TPB was used in Moore and Burrus (2019) to examine intentions to choose STEM majors and careers among 1,958 high school students in the United States. It was found in the study that perceived behavioural control did not have significant influence on students' STEM choice, and attitude was the only significant predictor (Moore & Burrus, 2019). Conversely, Solikhah (2014) reported that perceived behavioural control had influence on students' career interest in public accounting in which interest would encourage them to plan for their future career as an accountant. It was noticed that empirical research regarding the influence of perceived behavioural control on STEM career choice intention was rather thin in literature. However, there were various studies that discussed self-efficacy in relation to STEM pursuits where controllability was absent because these studies were not based on the TPB. Pertaining to STEM, van Aalderen-Smeets and Walma van der Molen (2018) reported that self-efficacy plays a vital role in STEM career decision making. It was noted that students' self-efficacy in Mathematics was correlated to their choice in STEM majors in college and can predict science and mathematics career interest (van Aalderen-Smeets & Walma van der Molen, 2018). However, it was also reported that there were some students with high self-efficacy beliefs, but did not pursue STEM (van Aalderen-Smeets & Walma van der Molen, 2018). Besides, Halim, Rahman, Ramli, and Mohtar (2018) found that Malaysian students' STEM self-efficacy was positively correlated to interest in STEM careers. It was highlighted that both STEM self-efficacy and career interest are considered internal factors that influenced STEM career decisions (Halim, Rahman, Ramli, & Mohtar, 2018).

Furthermore, Ajzen (2002b) who suggested that perceived behavioural control can account for substantial variance in intention and actual behaviour. As explained by Ajzen (2002b), Kong et al.'s (2020) also noted that intention was grounded on perceived behavioural control. This is supported by Moore and Burrus (2019) found that perceived behavioural control was related to students' college major intention and career intention in STEM. Tey et al. (2019) also revealed that perceived behavioural control had significant influence on students' STEM career choice intention. In other words, students' decision in STEM careers can be determined by their perceived ability, confidence, control and perceived difficulty level in STEM (Tey et al., 2019).

In other instances, perceived behavioural control in Ambad and Damit (2016) refers to an individual's perceived personal ease or difficulty to conduct an entrepreneurial behaviour. It was revealed in their study that perceived behavioural control had a significant influence on undergraduates' entrepreneurial intention. This means that when students think it is easy for them to become an entrepreneur, they would be more motivated to pursue entrepreneurship (Ambad & Damit, 2016). Similarly, Sieger and Monsen (2015) explained that perceived behavioural control comprised self-efficacy and perceived controllability. In their study, individuals with greater entrepreneurial self-efficacy and perceived controllability strengthened their desirability and efficacy towards entrepreneurship, hence they had higher career choice intention in entrepreneurship (Sieger & Monsen, 2015).

Therefore, the following hypotheses were proposed based on the literature review:

H1: Perceived behavioural control has a significant influence on career interest.

H2: Perceived behavioural control has a significant influence on career choice intention.

2.5.2 Attitude Towards Career Choice

Attitude is one of the core constructs in the TPB that predicts behavioural intention. Attitude is generally defined as an individual's positive or negative evaluation towards a behaviour (Ajzen, 1991). It was also suggested that attitude was determined by an individual's beliefs about an anticipated consequence resulting from an intentional behaviour (Bidin et al., 2012). Aziz et al. (2020) also defined attitude similarly that attitude is an indication of favourable or unfavourable judgement. On this basis, individuals would be more likely to opt for the choice which they show greater preference (Aziz et al., 2020).

Based on Regan and DeWitt (2015), attitude can be defined according to the contexts of research. Regan and DeWitt (2015) argued that attitude is an overarching term that has been extensively used as a preceding construct of behaviour. Pertaining to science, Ong et al. (2020) operationalized attitude as science-related attitudes which can be categorised into scientific attitude and attitude towards science. Likewise, Bidin et al. (2012) specified attitude in the context of entrepreneurship as attitude towards entrepreneurship which refers to a person's desire to become an entrepreneur. Therefore, attitude in the current study was specified as attitude towards career choice to denote students' favourable or unfavourable evaluation towards STEM career choice.

As posited in the TPB, Aziz et al.'s (2020) research found that there was a significant positive relationship between attitude and intention. In fact, many prior studies have confirmed attitude as a significant predictor of intention in various research contexts and via the TPB (Al-Swidi et al., 2014; Bidin et al., 2012; Wan et al., 2014). Badri et al. (2016) suggested that the emphasis on attitude in research, and particularly in the context of STEM is due to its association with students' willingness to engage themselves in STEM educational and career pathways. Wan et al. (2014) elaborated in their study that students' attitudes toward the hospitality and tourism industries is important because it offers better understanding about the career prospect and students' intention to join the workforce.

Bidin et al. (2012) mentioned in their research that the predictability of attitude on intention has been repeatedly tested in past studies in which attitude has significant and strong influence on intention. The findings from Bidin et al. (2012) also confirmed that attitude was indeed a significant predictor of students' entrepreneurial intention. Through the TPB, Solikhah (2014) found that attitude towards certified public accountants could have influence on favourable intentions to opt for an accounting career.

Besides intention, the relationship between attitude and interest has also been frequently discussed in previous research. As Yerdelen et al. (2016) suggested, there was a number of prior research that reported on the influence of students' attitude towards STEM on their career interest in the STEM fields. With that, Yerdelen et al.'s (2016) research investigated the relationship between students' attitude and career interest in STEM. It was revealed in their findings that students' STEM attitude was positively related to their career interest in all domains of STEM except technology. Based on the findings, Yerdelen et al. (2016) emphasised on the importance of students' attitude towards STEM to enhance their interest in STEM profession which will eventually affect their career choice in future.

According to Wiebe et al. (2018), students develop attitudinal associations between STEM careers and their academic and life experience since their primary education. Ong et al. (2020) noted that students with positive attitudes towards science were generally more engaged and focused on learning science. These students also demonstrated better scientific processing skills which would lead to interests and course choice in science (Ong et al., 2020). A similar finding was also found in James et al. (2018) that students who indicated a positive attitude towards the pharmacy profession also had greater intention to pursue education and career in the field. Badri et al.'s (2016) research reported that students' attitude towards science had a significant influence on their academic and career interest, as well as future job expectation. From the finding, Badri et al. (2016) highlighted the importance of students' positive attitude towards science in ensuring their future pursuits and performance in the STEM fields.

Based on the TPB and past studies, the following hypotheses were postulated to examine the influence of attitude towards career choice on career interest and career choice intention:

H3: Attitude towards career choice has a significant influence on career interest.

H4: Attitude towards career choice has a significant influence on career choice intention.

2.5.3 Subjective Norms

In the TPB, subjective norms are defined as a person's perceived social pressure from significant others to perform or avoid a specific behaviour (Ajzen, 1991). The important people are also known as salient referents whom an individual regarded important in decision making. From the review of literature, parents (Chong, 2019; Halim, Rahman, Zamri, & Mohtar, 2018; Razali, 2021), teachers (Akosah-Twumasi et al., 2018; Hsiao & Nova, 2016; Kong et al., 2020), and friends (Bergin, 2016; Mohtar et al., 2019; Zhang & Huang, 2018) were the most frequently mentioned referents in discussions of career choice. This is consistent with Hoag et al. (2017) which suggested that important people whom the students regarded influential in their decisions included parents, friends, teachers. Therefore, important referents in this study refer to students' teachers, parents and friends.

Subjective norms denote a student's perceived social pressure from their teachers, parents and friends concerning their choice of career in STEM. There were many studies which have examined the influence of teachers, parents and friends in students' career choice and interest. According to Wang and Degol's (2013) study, it was reported that teachers, parents and friends were influential over students' engagement in STEM-related activities. Teachers were perceived as students' role models who were the primary source of support in the academic setting (Bergin, 2016; Wang & Degol, 2013). On the other hand, students' perceptions about careers were shaped by the home environment which their parents offered (Bergin, 2016; Wang & Degol, 2013). It was also found that teenage students were more likely to conform to peer norms and develop similar pursuits that their peers intend to pursue (Bergin, 2016; Wang & Degol, 2013; Raabe et al., 2019). In the same vein, Zhang and Huang (2018) reported that friends were important emotional support, suggestions and information related to careers.

Pertaining to STEM career choice, Mohtar et al. (2019) highlighted that teachers, parents, and friends play vital roles in offering support to the students because they were closest people around students and could affect their interest and career choice in STEM. Mohtar et al. (2019) explained that teachers were essential in supporting students' STEM learning and careers. Besides, parents and family members establish a foundation for students' career decisions by offering them STEM experience outside the classrooms, and parents' encouragement was effective in guiding students to explore science-related careers (Akosah-Twumasi et al., 2018; Mohtar et al., 2019). Akosah-Twumasi et al., (2018) noted that peer influence could affect students' career decisions when they were prone to social comparisons and acceptance. Meanwhile, Hsiao and Nova (2016) argued that accounting students considered their friends as reliable referent whom they could seek help and discuss career interests and pursuits.

In relation to STEM career choice, the role of parents was most frequently discussed. Halim, Rahman, Zamri, and Mohtar (2018) reported in their research that parental support was essential in students' choice on stream of study at the upper secondary level, increasing students' interest and career choice in science. In addition, Razali (2021) termed parental influence on students' STEM career choice and interest as parental authority. According to Razali (2021), parents with a high level of understanding, mastery and awareness about STEM would facilitate students' STEM career development starting from secondary school by instilling interest and guiding major choice at tertiary education to prepare them for STEM careers in future (Razali, 2021). Likewise, Chong (2019) confirmed that students were more likely to choose STEM careers if their parents were knowledgeable in STEM. As emphasised in Chong (2019), the Malaysian MOE outlined in its educational policy that parents should assist their children in STEM learning, raise awareness about STEM careers, and improve their achievement and motivation to venture into the STEM fields.

Through the TPB, Kong et al.'s (2020) research found that parents and friends had significant influence on students' career choice. Normative pressure was found to be influential in career decisions among students (Krupat et al., 2017). Based on Krupat et al. (2017), normative pressures from mentors, family and friends were the most influential in choosing a research career. Furthermore, normative pressure in Sieger and Monsen (2015) refer to expectations from parents, friends and fellow students. Sieger and Monsen (2015) found that subjective norms were the best predictor of career choice intention in entrepreneurship.

It was noted in Badri et al. (2016) that while parents are assumed to contribute to their children's preconceptions of STEM careers, teachers are responsible in reshaping students' judgement and attitudes toward science and the careers. Aziz et al. (2020) argued that subjective norms in the TPB was not only a significant predictor of intention but also a predictor of attitude. For this reason, Aziz et al. (2020) investigated the influence of subjective norms on attitude and intention. It was confirmed that subjective norms had a significant influence on both attitude and purchasing intention. This finding is supported by Al-Swidi et al. (2014) which reported that there was a significant causal path from subjective norms to attitude towards purchasing intention. Nevertheless, as Aziz et al. (2020) mentioned, there was limited literature that examined the influence of subjective norms on attitude, particularly in STEM and career choice research.

In view of the evidence from the literature and to preserve the TPB concept, the following hypotheses were formulated:

H5: Subjective norms have a significant influence on career interest.

H6: Subjective norms have a significant influence on career choice intention.

H7: Subjective norms have a significant influence on attitude towards career choice.

2.5.4 Media Exposure

In Ayar (2015), media refers to television, books, internet, seminars, and news. Based on the Aziz et al. (2020), media involves the transmission of messages via information vehicles such as printed materials, radio, television, and online notice. The roles of media include spreading information and data (Aziz et al., 2020). Media exposure is defined as the opportunity and frequency for a reader, viewer or listener to receive information from any type of media that helps shape the person's beliefs (Qader & Zainuddin, 2011). Some instances of media include television, newspapers and social media, books, radio and the internet (Halim, Rahman, Zamri, & Mohtar, 2018; Saleem et al, 2014; Sharma, 2015).

According to Qader and Zainuddin (2011), the process which listeners, viewers, or readers receive messages delivered via media devices would affect their attitude and behaviour in the long run. It was argued that even if the impact of information is small, when it is repeated and spread in an accumulative manner over a period, the effect of communication would be powerful (Qader & Zainuddin, 2011).

Since the 1980s, past studies have linked media effects to occupational aspirations (Gehrau et al., 2016). Sharma (2015) indicated that the young generation of digital natives who grow up with the media and their perception towards the surrounding world is also influenced by the media. In this digital era, media have taken over modern lives in which media is used extensively for communications and exchange of information with facilitation of new technologies (Hoag et al., 2017). The young generation is particularly media-prone since they grow up with high exposure to media, thus shaping their perceptions of their surrounding world (Sharma, 2015). As people's lives have become more media-oriented, media has become their primary reference tools and affect personal choices (Saleem et al., 2014; Sharma, 2015).

Geschke et al. (2010) claimed that media portrayal of an occupation would contribute to the perpetuation of attitude and stereotyping. According to Hoag et al. (2017), media exposure can influence the adolescents' perceptions towards careers based on how they are portrayed in the media. Media is deemed to be influential in presenting information about the occupations shown such as income, image and social status (Sharma, 2015). This can shape the adolescents' ideas of the professions with rich contents due to the widespread of information through media such as television programmes and advertisements (Sharma, 2015). It is because media is regarded to be the main source in adolescents' occupational learning, and subsequently influences their career aspirations and choices (Gehrau et al., 2016; Saleem et al., 2014; Sharma, 2015).

Furthermore, Gehrau et al. (2016) explained that when an occupation is presented as attractive frequently in the media, it could affect a person's preference and judgement towards the occupation, hence influencing career aspirations. Hence, media plays a crucial role in raising interest and providing career-related information to adolescents, as well as determining their career choices (Gehrau et al., 2016; Saleem et al., 2014; Sharma, 2015). Besides, Kricorian et al. (2020) revealed that students followed STEM news on social media and websites, and watched movies or shows about STEM careers which they perceived relevant. Hence, Kricorian et al. (2020) suggested that media should be used to encourage and support students' pursuits in STEM because it can act as a potential pathway for STEM career mentorship.

Indeed, media exposure was found to be a determining factor that predicted career interest in previous studies. In Dou et al. (2019), media such as books and televised media were found to be impactful on students' career intention in STEM because they inspired students about the work and activities that they had not experienced yet. According to Mohtar et al.'s (2019), there are two categories of media: Printed and electronic. Media in their research included the internet, books, newspapers, television, radio, social media, movies, comics, scientific magazines, and digital games. It was reported in Mohtar et al. (2019) that students' exposure to media would affect their perceptions of STEM careers, and subsequently influence interest in STEM careers. Therefore, Mohtar et al. (2019) recommended the stakeholders to emphasise on the use of media to provide quality materials in cultivating STEM career interest among students.

Pertaining to STEM, Steinke (2017) noted that media exposure is especially important for teenage students because their exposure of STEM professionals via the media since childhood has framed their perception towards the professions. When adolescents have to decide their professional pursuits, media images of STEM professionals which had been constructed during their exposure to media would function as the primary source of considerations (Steinke, 2017). Using the TPB, Qader and Zainuddin (2011) revealed that media exposure could influence intention. Media also shaped consumers' attitude which would ultimately influence their purchasing intention (Qader & Zainuddin, 2011). More recently, Osita (2020) reported on the influence of media exposure on career choice in agriculture major and career. It was found in the study that more than 80% of the students were frequently exposed to audio-visual media such as television. Osita (2020) concluded that the higher the secondary school students' exposure to media, the higher the likelihood they would choose a career in agriculture.

Based on the literature, the following hypotheses were proposed in this study to examine the influence of media exposure on career interest, career choice intention and attitude towards career choice:

H8: Media exposure has a significant influence on career interest.

H9: Media exposure has a significant influence on career choice intention.

H10: Media exposure has a significant influence on attitude towards career choice.

2.5.5 Financial Reward

Financial reward is a type of physical benefit that influences students' career choice (Sugahara & Boland, 2009). According to Kong et al. (2020), financial reward consisted of bonus, compensation, salary, and other economic motivators. Financial reward can also be described as monetary outcomes such as incentive, pay, commission, allowances, merit pay, and bonus that an individual strives for at work (Harunavamwe & Kanengoni, 2013). Based on Wong et al. (2017), financial reward refers to a form of monetary benefit such as high salary, paid sick leave, overtime pay, and complimentary pay that an employee seeks as compensation for their work. In this study, financial reward refers to a secondary school student's expected monetary outcome towards their career choice in STEM.

As suggested in Choo et al. (2012), financial reward has been one of the most common factors in the career choice literature. Indeed, many past studies in the existing literature have proven the significant influence of financial influence on career choice across various disciplines. In general, most male medical graduates in South Asia and the Middle East placed priority on financial reward when they planned for career pathways (Deedar-Ali-Khawaja & Khan, 2010). Another example is Aggarwal et al.'s (2012) study which reported that students intended to choose dentistry as a profession because they expected the career would facilitate them to obtain lucrative income. Besides, Hayes and Shakya (2013) also found that monetary reward had a significant influence on students' choice in dentistry and pharmacy.

In relation to STEM, Choo et al.'s (2012) study aimed to determine factors that influence the career choice among engineers in Malaysia. Their research found that perception of financial reward was a significant factor that influenced engineers' career choice (Choo et al., 2012). Therefore, Choo et al. (2012) recommended that the attractive financial compensation and monetary reward such as bonus and pay should be highlighted to recruit new talents in the field of engineering. According to Xu (2013), financial reward was considered a form of monetary benefit and extrinsic outcome of a profession such as salary and pay rate. Xu's (2013) study confirmed that pay rate was a prominent monetary factor that dominated career choice among college graduates. High pay rate would increase STEM graduates' tendency to choose a career related to their major because they identified STEM as a field that demanded corresponding qualifications to earn the benefits (Xu, 2013).

In Ahmad et al. (2015), monetary reward and lucrative salary were considered extrinsic interests that drive students towards accounting careers. It was suggested that expected future income was one of the most important factors that led to accounting career choice among students in Malaysia (Ahmad et al., 2015). For this reason, students were more interested in accounting careers when students perceived an accounting career would create greater openings in financial secured future and opportunities (Ahmad et al., 2015). This was supported by Wan et al. (2014) that salary and bonus were categorised as extrinsic reward which was crucial in career choice. In specific, when students expected the career would offer better monetary incentives and rewards, their choice intention towards the career would be higher (Wan et al., 2014).

According to Harunavamwe and Kanengoni (2013), employees perceived monetary reward as a scorecard that reflects an organization's value, and impersonal motivation that geared them towards short-term goals at work. Monetary reward could exert a positive influence on employees' motivation when employees thought their employers provided financial reward (Harunavamwe & Kanengoni, 2013). Similar result was found in Samsuri et al. (2016) which suggested that salary was one of the primary factors that accounting undergraduates took into consideration while opting for a career in accounting. In their study, salary was denoted as the payment and remuneration an employee received for his or her services to the employer (Samsuri et al., 2016).

Furthermore, Puertas and Rivera (2016) found in their study that income was a significant factor in students' career and specialty choice. Hence, potential income that would be generated from a career was associated with quality of life. Hence, based on their finding, students' perceptions of salary were decisive of their career choice intention (Puertas & Rivera, 2016). Findings from Sithole et al. (2017) showed that salary was an important factor for fresh graduates while planning for future careers. In the qualitative research, most of the participants mentioned the importance of financial compensation and salary because employment was a means to earn financial income for living (Sithole et al., 2017). Sithole et al. (2017) also revealed that money and short-term financial reward were the priority for those who opined employment was stressful and tiring.

In the accounting context, Wen et al. (2018) argued that even though many studies had reported the imperative role of salary on students' career choice and preference, their study found otherwise. Based on Wen et al.'s (2018) findings, there was no significant relationship between financial factor and career choice intention in public accounting among students in China. Kong et al.'s (2020) investigated the influence of financial reward on students' career choice intention in accounting using the TPB. In contrast to Wan et al. (2014), Kong et al. (2020) revealed that financial reward was significantly related to accounting students' career choice intention. This is because students valued salary, compensation, and bonus as economic motivators that would lead to their decision in choosing an accounting career (Kong et al., 2020).

As Choo et al. (2012) suggested, the literature on financial reward regarding career choice is rich; however, there is a dearth of research regarding students' STEM career interest and intention. Hence, the following hypotheses were postulated:

H11: Financial reward has a significant influence on career interest.

H12: Financial reward has a significant influence on career choice intention.

2.5.6 Career Interest

Career interest can be described as the pattern of likes, dislikes and indifferences regarding any activities that are related to careers and occupations (Bonitz et al., 2010; Lent et al., 1994). Based on Humayon et al. (2018), interest denotes students' interest in their choice of careers (Humayon et al., 2018).

According to Liaw et al. (2017), personal interest was defined as students' personal interest in their chosen careers. Interest was derived from intrinsic values such as to help others and make a change in others' lives (Liaw et al., 2017). According to Ali et al. (2018), Malaysia needs to promote students' interest in STEM not only for literacy but also to develop career involvement in the STEM fields.

From the review of literature, Ong et al. (2020) described interest as a motivational variable that is triggered by positive affection that emerged from the interaction with an object. It was also pointed out that career interest is persistent over time, thus it is commonly used to predict career-related behaviour such as career choice (Ong et al., 2020). Additionally, Humayon et al. (2018) asserted that interest and career choice were closely related because interest encouraged students to explore contents and activities they favoured. When students became skilful in the areas they were interested in, they would choose to pursue careers that match their interest (Humayon et al., 2018).

In the STEM context, Murcia et al.'s (2020) research focused on the factors that influenced secondary school students' career decision making in STEM. From their findings, it was reported that 66% of the students intended to choose a career in STEM because of interest and personal strengths (Murcia et al., 2020). Razali (2021) also asserted that students' positive interest is a key to prepare students for careers in STEM. This is supported by Moore and Burrus's (2019) study which employed the TPB to predict students' STEM major and career choice. It was found in their study that interest was an influential predictor of career choice in STEM (Moore & Burrus, 2019).

Besides, Blotnicky et al. (2018) indicated in their findings the influence of interest on career choice were two-edged. It was revealed that career interest indeed had significant influence on career intention in which students who were interested in technical and scientific skills had great intention to pursue a career in STEM (Blotnicky et al., 2018). However, it was argued that interest was not a definite antecedent of career choice intention because students with great career interest would also avoid choosing STEM careers due to other reasons such as incompetency.

Similarly, Razali et al.'s (2017) conducted in Malaysia also found that career interest in STEM was instilled through integration programmes as interest was assumed to guide students to STEM careers. Based on Ayar (2015) interest is associated with affective and cognitive features which an individual is engaged in. As Ayar (2015) reported, complementary activities were found effective to develop students' interest in STEM and subsequently motivate them to choose STEM careers. In particular, robotics activities were useful in instilling and sustaining students' interest in engineering and inspiring them to pursue a career in engineering (Ayar, 2015).

It was reported in Nugent et al. (2015) that students were more likely to pursue careers they were interested in. It was highlighted in Nugent et al. (2015) that students' interest in STEM had both direct and indirect effect on career orientation. Similar finding was also reported in Yerdelen et al. (2016) that career interest among students was crucial in predicting their choice of career in STEM. Sadler et al. (2014) explained that interest is derived from students' experiences which eventually leads them to choose STEM as a career.

Building on the literature, the following hypotheses were formulated to examine the influence of career interest on career choice intention in STEM:

H13: Career interest has a significant influence on career choice intention.

2.5.7 Career Choice Intention

In general, behavioural intention is an indication of how hard an individual is willing to try and plan to execute a particular behaviour (Ajzen, 1991). From the literature review, it was understood that career choice intention is commonly researched in disciplines such as entrepreneurship (Cano & Tabares, 2017), tourism (Chen et al., 2020), and STEM (Dou et al., 2019). Based on each respective research context, career intention was defined operationally to meet the objectives of the studies.

Career intention in Mokhtar et al. (2016) refers to entrepreneurial intention which indicates an individual's likelihood to pursue entrepreneur as a career. On the other hand, Chen et al.'s (2020) research on tourism defined career intention as the degree to which a student has formulated tentative plans whether to execute some specified future behaviour or not. Chen et al. (2020) suggested that when students' occupational beliefs and interests match their career goals, students' career choice intention can be predicted by their choice of majors.

Students' career choice intention is also an indication of their pursuit after they complete their education (Chen et al., 2020). Based on Mokhtar et al. (2016), intention is the central construct of TPB. Career intention can be determined by attitude, subjective norms and perceived behavioural control as posited in the theory (Mokhtar et al., 2016). Like Mokhtar et al. (2016), career choice intention in this study was derived from the TPB which refers to a secondary school student's willingness and plan to choose a career in the field of STEM.

In past studies, behavioural intention has been widely investigated as a dependent variable in research because it is a powerful prelude to predict actual behaviour (Moore & Burrus, 2019). Kong et al. (2020) noted that intention represents significant factors that affect desired behaviour, whereby the stronger the intention, the higher the possibility to practise the behaviour. Ajzen (1991) also suggested that intention is the immediate precursor and proximal determinant to performing behaviour.

This is supported by Moore and Burrus's (2019) study which found that students' STEM career intention was the strongest predictor of their choice of career in STEM. According to Moore and Burrus (2019), students who indicated likelihood to engage in STEM-related behaviour are more likely to choose a STEM career than those who did not (Moore & Burrus, 2019). This echoed with Cano and Tabares's (2017) which reported that intention is the most effective predictor of actual behaviour, and behavioural intention in the TPB is extensively used as a fundamental variable in explaining future behaviour. For this reason, many previous studies in the literature research on career intention with TPB as the theoretical foundation. On this basis, intention related to career choice was examined through the TPB in which intention was the outcome variable with attitude, subjective norms, and perceived behavioural control as the proposed factors that influenced intention. (Ambad & Damit, 2016; Krupat et al., 2017).

Furthermore, there are also instances of past studies that examined career choice intention without TPB. Pertaining to STEM career intention, Dou et al. (2019) investigated early informal STEM experiences and STEM identity by focusing on the factors that influenced students' intention in STEM career. In Dou et al. (2019), the participants were 15,847 college freshmen from 27 higher learning institutions located in 20 different states of the United States. This research examined the relationship between participants' childhood STEM-related experiences, STEM identity, and career intentions. In particular, STEM career intention was used as a binary dependent variable in which the respondents had to select a career in a STEM or non-STEM field while answering the survey. The list of STEM and non-STEM careers was demarcated based on the National Science Board of the United States. As a result, Dou et al. (2019) found that students' STEM identity had a significant influence on their intention to pursue a STEM career in university or college.

According to Blotnicky et al. (2018), Mangu et al.'s (2015) study that involved 24,000 students from Grade 9 to Grade 11 showed that youth's career knowledge and interest in STEM had a direct influence on their intention to pursue a STEM career. In Mangu et al. (2015), career intentions in STEM among students changed dramatically during Grade 9 to Grade 11 due to their familiarity with STEM careers and guidance they received in schools during the period. Thus, STEM career intention is regarded as time-sensitive because students' occupational intention in change could also be affected by time alongside factors such as STEM knowledge and interest (Blotnicky et al., 2018; Mangu et al., 2015).

2.6 The Mediating Variables

This section reviews the mediating variables (attitude towards career choice and career interest) as postulated in Objective 2. The literature related to the proposed mediators will be reviewed in this section to support the hypotheses.

Badri et al. (2016) suggested that indirect effects occur when there is at least one latent variable that mediates the relationship between an exogenous and an endogenous variable. According to MacKinnon (2008), mediation is present when two criteria are met: (a) A significant influence from an independent variable to a mediator, and (b) A significant influence from a mediator to a dependent variable. It indicates a partial mediation when the regression coefficient between an independent variable and a dependent variable remains significant but undermines after the addition of a mediator (Baron & Kenny, 1998). On the contrary, when the relationship between the independent variable and dependent variable becomes insignificant after the mediator is added, it implies a full mediation (Baron & Kenny, 1998).

Thus, this study investigated the potential mediation of attitude towards career choice and career interest based on the hypotheses as proposed in the preceding sections. The subsequent sections discuss the potential effects of attitude towards career choice and career interest which may mediate between the constructs postulated in the conceptual framework of this study.

2.6.1 Attitude Towards Career Choice as a Mediator

As reviewed in the previous sections, subjective norms and media were postulated to have significant influence on attitude, in turn attitude would influence career interest and intention. Hence, attitude was hypothesised to be a significant mediator in the TPB in the present study.

Using the TPB, Al-Swidi et al. (2014) investigated the influence of subjective norms on intention via attitude. The finding validated the mediating effect of attitude between subjective norms and intention, while subjective norms indeed had both direct and indirect influence on intention. The mediating effect of attitude in the TPB was also reported in Mokhtar et al. (2016). In their research, attitude was a partial mediator that had an indirect effect on the relationship of need for achievement and entrepreneurial intention. More recently, another evidence of attitude as a mediator in the TPB was found in Aziz et al. (2020). In Aziz et al., (2020), human referents and media referents were categorised under subjective norms. The research confirmed that attitude was a significant mediator that intervened the influence of subjective norms on intention (Aziz et al., 2020).

Pertaining to STEM career choice, van Aalderen-Smeets and Walma van der Molen (2018) suggested that students' attitudes towards STEM career were influenced by significant others and the media which would lead to their STEM career choice in future. Besides, Minton et al. (2018) reported on the mediating role of attitude using the theory of reasoned action. It was revealed in Minton et al. (2018) that attitude mediated the relationship between subjective norms related to pragmatism in a country and sustainable behaviours in the United States and France, but not in Japan. Moreover, attitude shares similar definition as outcome expectation in social cognitive career theory which proposes outcome expectation as a mediator between self-efficacy (known as perceived behavioural control in TPB) and interest, as well as the relationship between self-efficacy and choice intention (Lent et al., 2002; Moses et al., 2018).

From the literature, attitude was most examined as a mediator in marketing research. Lim et al.'s (2017) study validated the mediating effect of consumer attitude between social media influence and purchase intention. It was explained that attitude played a significant role in translating their preferences obtained from advertised contents to buying willingness (Lim et al., 2017). A similar study by Abzari et al. (2014) also found that both traditional media and social media had indirect influence on purchase intention through attitude. While media was prevalently used to spread information to promote products, it influenced consumers' attitude by shaping favourable impressions towards the advertised products, hence encouraging their intention to purchase (Abzari et al., 2014). Based on the literature, the following hypotheses were formulated:

H14: Attitude towards career choice mediates the influence of subjective norms on career interest.

H15: Attitude towards career choice mediates the influence of subjective norms on career choice intention.

H16: Attitude towards career choice mediates the influence of media exposure on career interest.

H17: Attitude towards career choice mediates the influence of media exposure on career choice intention.

2.6.2 Career Interest as a Mediator

As reviewed in the previous sections, prior research provided evidence on the influence of perceived behavioural control, attitude towards career choice, subjective norms, media exposure, and financial reward on career interest. Likewise, previous studies also demonstrated in the career choice context that interest can lead to students' career choice. Based on the literature, this study postulated career interest may act as a mediator that intervenes the relationships between the antecedents and career choice intention in the proposed research model.

According to Sadler et al. (2014), STEM career interest is regarded as a pathway that can be influenced by several aspects to improve students' interest and subsequently join the STEM careers. This is reflected in Mishkin et al. (2016) which explained TPB entails interest and choice were resulted from decision-making processes namely attitudes, subjective norm and perceived behavioural control. These processes will later lead to an individual's intention to determine whether the person should perform a behaviour or not (Mishkin et al., 2016). These suggested career interest could be a potential factor that mediates attitude, subjective norm and perceived behavioural control with intention.

The mediating role of career interest is also supported by social cognitive career theory which shares similar constructs as TPB (Sahin et al., 2015). Attitude in TPB and outcome expectation in social cognitive career theory both denote similarly as an individual's evaluation that a given behaviour will produce a particular outcome. Interest plays a mediating role between choice goals and outcome expectations in social cognitive career theory (Lent et al., 2002), thus suggesting interest could similarly mediate attitude towards career choice and career choice intention in TPB. Taking into consideration that carer interest is a precursor of career choice intention, and with support from the literature that the predictors of career interest (attitude towards career choice, subjective norms, perceived behavioural control, media exposure and STEM programmes and strategies) had influence on career interest, it can hence be hypothesised that career interest is a mediator between the predictors of career interest and career choice intention.

In Nugent et al. (2015), students' parents, friends and teachers were found to be influential on their interest which led to their career choice in STEM. Interest was also reported as a mediator that intervened the relationship between career outcome expectation and self-efficacy among students (van Tuijl & Walma van der Molen, 2016). From Regan and DeWitt's (2015) review of literature, it was also noted that interest could have direct and indirect effects on students' choices related to science. Badri et al. (2016) also suggested that attitude alongside other factors such as environment, science classes had significant influence on students' interest, while interest influenced students' career expectation significantly. Besides, Solikhah (2014) noted the role of career interest in mediating perceived behavioural control and career plan among accounting students. Specifically, the indirect effect was greater than the direct effect, suggesting the influence of perceived behavioural control on career choice was larger through the mediator (Solikhah, 2014).

Furthermore, past studies also noted the potential mediating effect of career interest between other factors and career choice. For example, Razali et al. (2017) indicated that successful STEM integration programmes could positively affect students' career interest, and later pave students towards STEM career choice. Similar finding was also found in Ali et al. (2018) that a STEM programme facilitated students to develop interest in STEM, and eventually led them to consider STEM careers as their future pursuits. As Razali (2021) mentioned, the Malaysian MOE emphasised the importance of career interest by improving science curriculum to help students prepare for STEM careers via their career interest.

Therefore, the following hypotheses were formulated to assess the mediating role of career interest in students' STEM career choice intention.

H18: Career interest mediates the influence of perceived behavioural control on career choice intention.

H19: Career interest mediates the influence of attitude towards career choice on career choice intention.

H20: Career interest mediates the influence of subjective norms on career choice intention.

H21: Career interest mediates the influence of media exposure on career choice intention.

H22: Career interest mediates the influence of financial reward on career choice intention.

2.7 Streams of Study as a Moderator

The moderator proposed in this study was the stream of study among the students. The two streams of study were STEM and non-STEM. Pertinent literature will be discussed and reviewed in this section to elaborate the relevance of the moderator to the development of the H23 derived from Objective 3.

In Malaysia, secondary school students are allowed to choose the streams of study upon completing their lower secondary education when they complete Form Three. As detailed in Chapter 1.2.3, streams of study refer to students' enrolment to a stream of their choice, either the STEM or non-STEM stream for their upper secondary education (Shahali, Ismail, & Halim, 2017). The streaming system in the upper secondary school has a long history, and the latest STEM-oriented streaming system has been implemented to prepare all upper secondary school students for STEM careers in future.

Ertl and Hartmann (2019) found in their study that STEM and non-STEM students showed different magnitudes in their interest and orientation in career choice. In comparison of STEM and non-STEM students, Xu (2013) also highlighted that there were similarities and differences in terms of the factors that affected their choice of career. While comparing STEM and non-STEM students' career choice, non-STEM students were more affected by a set of comprehensive factors that included both monetary and non-monetary factors (Xu, 2013). Meanwhile, STEM students showed greater persistence in their choice of career in STEM as compared to non-STEM students (Xu, 2013). Xu (2013) explained that the finding was a result of the highly specific vocational training that STEM students received before they joined the workforce. In other words, STEM students were more likely to opt for STEM careers, while non-STEM students were also more intended to choose careers that related to their majors because non-STEM students may encounter challenges when seeking career opportunities in STEM. The difference in specificity of STEM and non-STEM training could be one of the keys that contributed to discernible choice of careers between the two groups of students (Xu, 2013).

Based on Yeung and Yeung's (2018) findings, it was argued that STEM and non-STEM students indicated clearer distinction in career choice when they were assessed according to ability factors, whereas the difference was ambiguous when it was assessed using affectionate factors. Besides, Bieri Buschor et al.'s (2014) longitudinal study involving a sample of 843 school students revealed that students who intended to pursue STEM actually enrolled themselves in STEM related courses later in the university. These students who chose STEM showed high persistence for pursuing STEM, also showed greater importance to STEM academic activities and STEM careers as compared to humanities and social sciences students.

In a study conducted by Alexander et al. (2011), 1868 students in South Africa were involved in the investigation on students' career choices between computer and non-computer disciplines. It was reported that there were similarities and differences between the two groups of students in terms of the factors that influenced their career choice. The results suggested that interest was a significant factor that influenced career choices of students from both computer and non-computer disciplines, whereas students' self-efficacy and career outcomes varied across academic disciplines (Alexander et al., 2011). Besides, very limited literature has explained whether STEM career choices would be different between STEM and non-STEM students in Malaysia. Therefore, the following hypothesis was proposed in the present study:

H23: The streams of study (STEM and non-STEM) moderate students' career choice intention in STEM.

2.8 Conceptual Framework

In line with the research objective to examine factors affecting career choices in STEM, this study proposed a research model of antecedents that influence STEM career choice intention among STEM and non-STEM students. As depicted in Figure 2.3, a conceptual framework was constructed based on the theoretical framework, TPB and the reviewed literature.

With TPB as the theoretical foundation, this study focused on the factors that influence students' intention to choose a career in STEM. Alongside the existing variables in the TPB, external variables derived from the literature were also included in the proposed model to investigate their predictability towards students' STEM career choice intention. Hence, the predictors prosed in this study were perceived behavioural control, attitude towards career choice, subjective norms, media exposure, financial reward, and career interest.

Out of the seven variables proposed in the conceptual framework, attitude towards career choice and career interest were postulated as the mediators in the conceptual framework based on the literature. Besides, students' streams of study would also be tested to investigate whether students' career choices varied between STEM and non-STEM students.

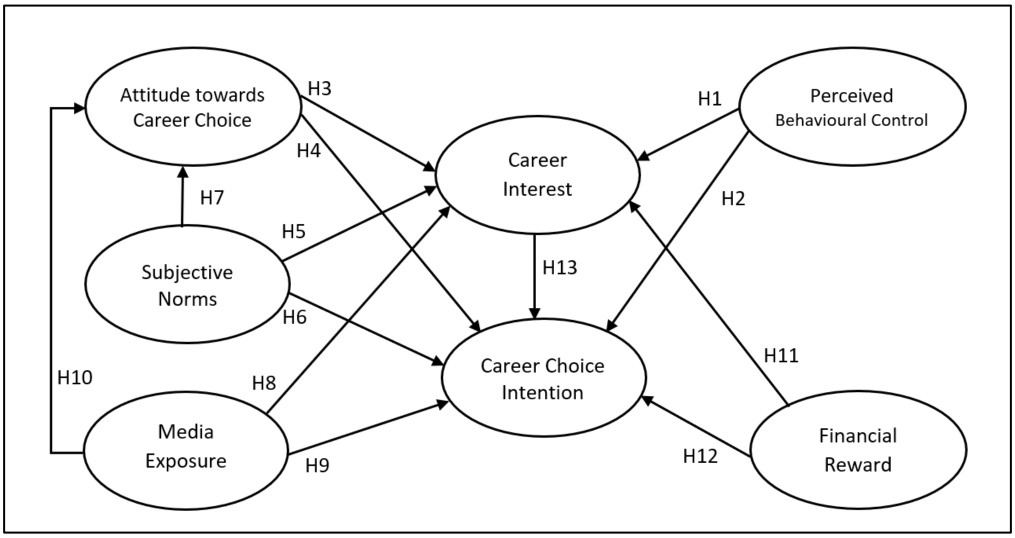


Figure 2.3: The Conceptual Framework of the Study

2.9 Concluding Remarks

This chapter offered the overview of the theories related to the study and entailed the rationale why TPB was chosen as the theoretical framework of this study. The theories and previous studies on career choices were presented in this chapter by reviewing the past research that were found useful to support this research. The proposed predictors, mediators and moderator were reviewed with literature related to the present study to present the overview of the development of the proposed model. In the literature review, the hypotheses were supported with evidence articulated from a combination of international and local literature to justify the proposed relationships as illustrated in the conceptual framework. The subsequent chapter will offer a detailed explanation on the methods and procedures employed in this study to examine the research hypotheses.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This study aimed to investigate the factors that influence career choice intention among STEM and non-STEM students via the TPB. In this chapter, the methodological procedures undertaken to meet the research objective will be presented systematically. Chapter 3 begins with a discussion on the research paradigm and design of the present study. This is followed by the location and population, as well as sampling of this study by outlining the sampling procedure, and determination of sample size. The subsequent section entails the development of the research instrument used in this study. It reviews the generation of measurements, translation and back translation, pre-test, and pilot test undertaken to produce the final questionnaire used in data collection. Ethical considerations and procedures of data collection are also discussed in Chapter 3. The closing section of this chapter introduces the plan for data analysis that will be reported in Chapter 4.

3.2 Research Paradigm and Design

A reasonable and justifiable research design is crucial to ensure the sturdiness of the study and to answer the research questions (Saunders et al., 2012). According to Cohen et al. (2017), research design is determined by the concept of “fitness for purpose” in which research methodology and planning should be guided by the research purpose. Research design is important to refine various aspects of research such as the methods, procedures, approaches, preparation of instruments, and collection of data by considering how these can help the researcher to answer the research questions (Cohen et al., 2017). Hence, it is crucial to determine the research design that can help the researcher to answer the research questions.

According to Creswell (2014), research paradigm refers to a set of assumptions and beliefs that govern the holistic philosophy in research. Based on Cohen et al. (2017), a positivist researcher is an observer in the social reality who explains human real-life behaviour manifests within a given context (Cohen et al., 2017). The positivist paradigm is usually based on existing knowledge and literature which support the researchers to verify the proposed hypotheses using data collected from samples from the targeted population (Saunders et al., 2012). Positivist approach allows researchers to test hypotheses, pre-determined relationships using quantitative methods so that inferences can be drawn from statistical analyses (Creswell, 2014). For this reason, quantitative results and interpretations generated from positivist studies are replicable and generalisable (Cohen et al., 2017; Creswell, 2014).

A quantitative approach is a survey design that allows hypothesis testing to understand individuals’ opinion on the topic discussed in research (Cohen et al., 2017). According to Cohen et al. (2017), a descriptive survey method allows the researcher to collect information from a large sample within the research scope and time. Besides, positivist researchers often use the survey design because it is useful in hypothesis testing and to interpret data numerically (Creswell, 2014). This is supported by Khaldi (2017) that positivists regard social sciences as similar to natural sciences in which the reality consists of measurable facts that causal relationships can be tested using statistics. Khaldi (2017) argued that there are three main research approaches in social science and educational research: Quantitative, qualitative, and mixed methods. It was emphasised in Khaldi (2017) that every approach is considered scientific, and all research should always conform to the scientific method to conduct research: (a) Define research problems, (b) review concepts and theories from the literature, (c) formulate research questions and hypotheses, (d) define research framework, tools, samples and procedures, (e) collect data, (f) analyse the collected data, and (g) test the hypotheses and discuss the results.

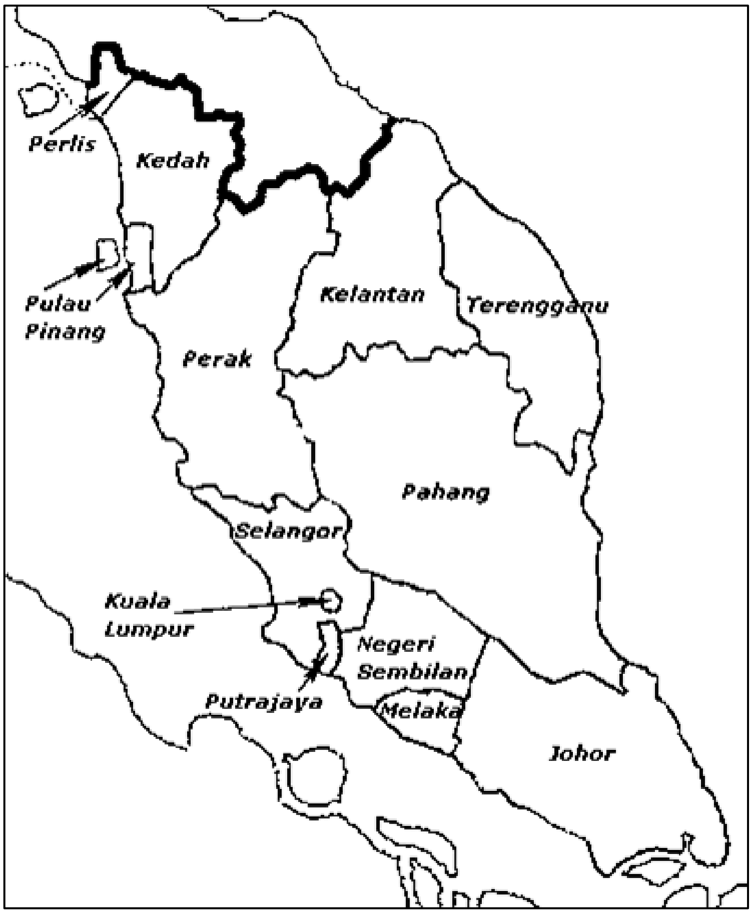
Considering the aforementioned, this study was based on a quantitative descriptive research design because the purpose of this study was to examine factors affecting students' career choice in STEM by testing the direct and indirect relationships in the proposed model. The application of the positivism paradigm in this study allowed the researcher to test the proposed research model and determine the hypothesised direct and indirect relationships based on the existing literature. As such, results from data analyses for hypothesis testing were also presented quantitatively to offer empirical findings that can be replicated in future research.

In line with the research objective, descriptive survey design would allow the researchers to determine the factors that influence to examine factors influencing STEM and non-STEM students' career choices through various proposed variables in the research model. Since the research objective is to build a structural model as well as to test hypotheses using statistical tools, a quantitative descriptive survey design is appropriate for the present study because it allows the researcher to collect data from large sample from different places within a short period of time and allow generalisation of findings to a larger population. Therefore, using a quantitative descriptive survey is an appropriate research design that enables the researcher to achieve the research objective economically and efficiently.

3.3 Location of the Study and Population

Malaysia is made up of West Malaysia (also known as Peninsular Malaysia) and East Malaysia. As shown in Figure 3.1, this study was scoped to Peninsular Malaysia which consists of the Central Region (Selangor, and federal states of Kuala Lumpur and Putrajaya), Southern Region (Johor, Negeri Sembilan, and Melaka), Northern Region (Perak, Kedah, Penang [or Pulau Pinang], and Perlis), and the East Coast (Kelantan, Pahang, and Terengganu) (Yahya et al., 2019). On the other hand, East Malaysia consists of Sabah, Sarawak and the Federal State of Labuan. According to the Educational Planning and Research Division (2019), there were a total of 357,592 Form Four students in Malaysia, of which 288,034 (80.55%) were from Peninsular Malaysia and 69,558 (19.45%) were from East Malaysia. As students from Peninsular

Malaysia represented the majority (80.55%) of Form 4 students in the country, this study encompassed all states in Peninsular Malaysia to offer a comprehensive representation in the investigation of antecedents influencing the career choices of secondary school students in STEM.



Note. The map was adapted from *States in Malaysia*, by Malaysia Central, 2021 (http://www.malaysiacentral.com/information-directory/states-in-malaysia/). In the public domain.

Figure 3.1: Map of Peninsular Malaysia

The target population of this study is STEM and non-STEM stream Form Four students in Peninsular Malaysia. As of June 2019, there were a total of 288,034 Form Four students enrolled in the upper secondary schools in Peninsular Malaysia (Educational Planning and Research Division, 2019). As shown in Table 3.1, 125,622 (44%) of them were from the STEM stream, while 165,412 (56%) of the students were from the non-STEM stream. Hence, the ratio of STEM to non-STEM students was 44:56.

Table 3.1: The Population of STEM and Non-STEM Stream Students in Peninsular Malaysia

Peninsular Malaysia		Stream of Study			
Region	State	STEM		Non-STEM	
		n	%	*n*	%
Central	Selangor	32,933	26	32,946	20
	Kuala Lumpur	7,734	6	8,197	5
	Putrajaya	672	1	754	0
South	Johor	18,669	15	25,254	16
	Negeri Sembilan	6,426	5	8,454	5
	Melaka	5,130	4	6,539	4
North	Perak	13,218	11	16,517	10
	Kedah	9,552	8	16,870	10
	Pulau Pinang	8,208	7	10,219	6
	Perlis	1,542	1	1,707	1
East Coast	Kelantan	7,658	6	13,488	8
	Pahang	6,845	5	11,246	7
	Terengganu	7,035	6	10,221	6
	Subtotal	125,622	100	162,412	100
	Proportion (%)	44		56	
	Population	288,034 (100%)			

Note. Statistics retrieved from Educational Planning and Research Division (2019).

3.4 Sampling

According to Barlett et al. (2001), an appropriate sample size is an important feature of quality research using surveys. Proportional stratified cluster sampling technique was used to select the sample in this research. Researchers are encouraged to select samples through stage sampling such as proportional stratified cluster sampling to reduce administrative issues and improve correspondents of data collection in a large population (Cohen et al., 2017; Gravetter & Forzano, 2018).

Proportional stratified cluster sampling is apt for this study which the population is large and widely dispersed geographically (Cohen et al., 2017). Stratified sampling is commonly used in research with a substantial number of populations, and it allows a researcher to group the population into homogeneous strata or subgroups, prior to random sampling from each stratum (Cohen et al., 2017). Subsequently, a researcher will identify the proportion of the population in correspondence to each subgroup. A sample is attained in which the proportions in the sample should correspond to the population (Gravetter & Forzano, 2018).

Hence, proportional stratified cluster sampling technique was used to select the sample in this research based on the ratio of STEM (44%) and non-STEM (56%) students in the population. Stratified sampling was also used to ascertain students from each state are represented proportionately according to the population. This is followed by cluster sampling which the schools were randomly selected from each state (stratum) based on a list of schools provided by the MOE using a table of random numbers until the targeted sample size was reached.

The sample size of this study was calculated based on the database retrieved from Malaysia Educational Statistics (2019). Sample size determination table published by Israel (1992) suggested when N >100,000, it is appropriate to recruit at least 400 respondents with ±5% precision levels where confidence level is 95% and p = .5. Besides, sample size larger than 200 is considered adequate to provide critical statistical power for subsequent data analysis (Hair et al., 2010). Since this study employed the SEM for data analysis, 100 to 150 samples would be sufficient for reliable results (Hair et al. 2010; Kline, 2015).

Furthermore, it was recommended to adopt the oversampling approach to obtain desired sample size in social science research (Barlett, et al., 2001). Israel (1992) also highlighted the common practice to aim for extra samples to compensate for non-response. It is suggested that the targeted number for mailed surveys could be significantly larger than the responses that need to be obtained (Israel, 1992). In this study, as the questionnaires were administered online via schoolteachers on a voluntary basis, it was aimed to collect extra samples to compensate for potential non-response.

Table 3.2 presents the targeted sample size for each state in Peninsular Malaysia. The complete responses needed for data analysis in this study is 400. As a result, a total of 806 responses were collected from Form Four students in Peninsular Malaysia based on the requirements aforementioned using proportional stratified cluster sampling method. A more detailed breakdown of the population and the calculation of samples are tabulated Appendix A2.

Table 3.2: Number of Form Four Students in Peninsular Malaysia

State	Target Sample[a]				Collected Sample[a]			
	STEM		Non-STEM		STEM		Non-STEM	
	n	%	*n*	%	*n*	%	*n*	%
Selangor	46	26	45	20%	92	26%	90	20%
Kuala Lumpur	11	6	11	5%	22	6%	22	5%
Putrajaya	1	1	1	0%	2	1%	2	0%
Johor	26	15	36	16%	52	15%	72	16%
Negeri Sembilan	9	5	12	5%	18	5%	24	5%
Melaka	7	4	9	4%	14	4%	18	4%
Perak	19	11	23	10%	38	11%	46	10%
Kedah	14	8	23	10%	28	8%	46	10%
Pulau Pinang	12	7	14	6%	24	7%	28	6%
Perlis	2	1	3	1%	4	1%	6	1%
Kelantan	11	6	19	8%	22	6%	38	8%
Pahang	9	5	16	7%	18	5%	32	7%
Terengganu	10	6	14	6%	20	6%	28	6%
Subtotal	177	100	226	100%	354	100%	452	100%
Proportion (%)	44		56		44		56	
Total	400 (100%)				806 (100%)			

[a]Sample size calculated through proportional stratified cluster sampling with reference to the database on population retrieved from Malaysia Educational Statistics 2019.

3.5 Instrumentation

According to Cohen et al. (2017), the questionnaire is a useful research instrument to collect data and information with and without the presence of the researcher. In view of its advantage, questionnaire is widely used in research and is most commonly used to collect numerical data that is convenient and efficient in data analysis (Cohen et al., 2017). Hence, this study used a survey questionnaire (Appendix C) to collect data to examine factors influencing students' career choice in STEM with TPB as the theoretical foundation.

The instrument used in this study was a bilingual questionnaire that was distributed online via school authorities; parental and respondent informed consent were sought prior to data collection (further details in 3.6 Ethical Considerations). As presented in Table 3.3, this questionnaire consisted of Part A and Part B. There were five items in Part A to collect background information about the respondents: Date of birth, gender, stream of study, name of school, and location of school. Part B contained seven sections, each measuring the respective variable proposed in the research model: attitude towards career choice, perceived behavioural control, subjective norms, financial reward, media exposure, career interest, and career choice intention.

Table 3.3: The Outline and Components of the Questionnaire

Part A	Part B
Date of birth	Attitude towards Career Choice
Gender	Perceived Behavioural Control
Stream of Study	Subjective Norms
Name of School	Financial Reward
Location of School	Media Exposure
	Career Interest
	Career Choice Intention

In Part A, it comprised both open-ended and closed-ended questions. General demographic information such as gender and date of birth was asked to collect basic information about the respondents' background. Respondents were required to indicate their stream of study in line with one of the research objectives of the study to test if streams of study acts as a moderator for students' career choice intention. To avoid confusion, the difference between STEM and non-STEM streams was noted in this item by listing the elective subjects for each stream of study so that the respondents could indicate their stream of study clearly. As such, respondents ticked on only one stream of study based on the elective subjects that they registered at school. Besides, respondents were also requested to write the name of school and indicate the location (state) of school so that the researcher would be able to identify the number of respondents needed based on the calculated sample.

There were six sections in Part B to measure the variables proposed in the research model. Specific instructions were provided in the beginning of each section. All items in Part B were measured on a five-point Likert scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). This study adapted a combination of existing and self-developed scales based on the review of literature. Ajzen (2002a) emphasised that different items could be used for different behaviours based on the research populations to ensure the internal consistency of the measures. Moreover, it was advised to select and design appropriate items in the formative stage of instrumentation (Ajzen, 2002a). Therefore, the TPB constructs (attitude towards career choice, perceived behavioural control, subjective norms, and career choice intention) were developed and adapted based on the guideline and manual provided by Ajzen (2002a) and Francis et al. (2004). Items of other constructs (financial reward, media exposure, career interest) were also developed and revised based on the context of the study by referring to previous studies and published scales as shown in Table 3.4 below.

Table 3.4: Sources of Scales Adapted for this Study

Variables	Number of Items	Sources of Scales
Attitude towards Career Choice	6	Ajzen (2002a) Francis et al. (2004)
Subjective Norms (Teachers, Parents, Friends)	15	Ajzen (2002a) Francis et al. (2004)
Perceived Behavioural Control	6	Ajzen (2002a) Francis et al. (2004)
Career Choice Intention	4	Ajzen (2002a) Francis et al. (2004)
Media Exposure	8	Hoag et al. (2017) Qader & Zainuddin (2011)
Financial Reward	8	Aggarwal et al. (2012) Ahmad et al. (2015) Liaw et al. (2017) Sugahara & Boland (2009)
Career Interest	8	Ahmad et al. (2015) Wan et al. (2014)

3.5.1 Measurements for TPB Scales

Ajzen (2002a) noted that when developing the TPB scales (attitude, subjective norms, perceived behavioural control, and behavioural intention), researchers need to ensure the measures are compatible with the contexts and target behaviour. In this study, the final behaviour was the choice of career in STEM, hence all TPB scales were operationalised in line with the behaviour under investigation to ensure the measures are compatible with the research objective.

Section 1 of Part B contained six items measuring students' attitude towards career choice in STEM. As aforementioned, attitude towards career choice was a scale from the TPB, thus the items were developed and adapted with reference to the manual and guideline supplied by Ajzen (2002a) and Francis et al. (2004). It was suggested to use both instrumental (e.g., useful, valuable) and experiential (e.g., pleasant, good) adjectives to form the items for attitude scale, wherever it is appropriate to the research to capture the overall meaning (Francis et al., 2004). Based on the objective of this study, the items were operationalised to the context of STEM career choice. The items for attitude towards career choice in STEM included instrumental adjectives such as "meaningful" (ATT4), and experiential adjectives such as "happy" (ATT 3). Based on this scale, the respondents rated their attitude towards career choice in STEM ranging from 1 = *strongly disagree* to 5 = *strongly agree* (Appendix C).

In Part B, Section 2 consisted of six items that measure perceived behavioural control which also originated from the TPB. With reference to Ajzen (2002a) and Francis et al.'s (2004) manuals, this scale should comprise a combination of items that reflect respondents' capability and controllability in terms of the behaviour under investigation. Capability can be assessed by developing items that capture respondents' confidence and difficulty in performing the behaviour (Ajzen, 2002a). Based on the guidelines, the perceived behavioural control scale used in this study was developed to capture students' capability and controllability. For example, PBC1 "I am confident I will be able to choose a career in STEM", and PBC6 "It is under my control to choose a career in STEM" (Appendix C). Every item in the perceived behavioural control scale was also measured using a five-point Likert scale from strongly disagree to strongly agree.

In Section 3 of Part B, there were a total of 15 items the subjective norms scale from TPB. This scale was also measured on a five-point Likert scale from strongly disagree to strongly agree. A unique feature of this scale is that it requires the researcher to identify the individuals or important referents that are likely to exude social pressure to respondents' behaviour (Ajzen, 1991; Francis et al., 2004). Based on the review of literature, the important referents that are likely to apply social pressure on students' career choice in STEM were their teachers, parents, and friends (Bergin, 2016; Wang & Degol, 2013). Therefore, the subjective norms scale in this study was adapted and developed with respect to each category of referent (teachers, parents, and friends), five items each (Appendix C).

Ajzen (2002a) suggested including both injunctive and descriptive items in the development of this scale. Injunctive items are direct measurements that refer to what important people think the respondents should do (Ajzen, 2002; Francis et al., 2004). In this study, an example of an injunctive item is such as SNT1 "My teachers think that I should choose a career in STEM". On the other hand, descriptive items should indicate whether the referents themselves involve in the behaviour under investigation (Ajzen, 2002a; Francis et al., 2004). Descriptive items developed in this study are such as SNF4 "My friends encourage me to choose a career in STEM". Another key in the measurement of subjective norms is to assess respondents' motivation to comply (Francis et al., 2004). Hence, the questionnaire item SNP4 "My parents' advice is important to my career choice in STEM" in this study is an example item developed based on this manual.

The scale for career choice intention was placed at Section 7 of Part B. The purpose of this section was to determine the students' career choice intention in choosing a STEM career in future. In this study, four intention items developed based on the examples provided in Ajzen (2002a). For example, items CCI1 "I will choose a career in STEM", and CCI4 "I plan to choose a career in STEM". The respondents were instructed to rate their intention to choose a career in STEM ranging from 1 (*strongly disagree*) to 5 (*strongly agree*) (Appendix C).

3.5.2 Measurements for Additional Variables

In Section 4 of Part B, financial reward was measured on a five-point Likert scale. This scale was used to survey students' opinion on financial reward when choosing a career in STEM. In the review of literature, it was found that the financial reward scales used to assess students' choice were limited, and the existing scales comprised very few items. For this reason, the financial reward scale was developed and adapted from Aggarwal et al. (2012), Ahmad et al. (2015), Liaw et al. (2017), and Sugahara and Boland (2009) to match the context of the present study. As shown in Table 3.5, the final scale for financial reward consisted of eight items, each rated with Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

Table 3.5: Items Used to Measure Financial Reward

Adapted Items	Original Items	References
FR1: A career in STEM pays well.	Ensures high income	Liaw et al. (2017)
FR2: A career in STEM will give me good long-term earnings.	Good long-term earning potential	Sugahara & Boland (2009)
FR3: A career in STEM will give me good starting salary.	Good initial salary	Sugahara & Boland (2009)
FR4: A career in STEM will give me stable income.	Dentistry offers stable work. Ensures a stable job	Aggarwal et al. (2012) Liaw et al. (2017)
FR5: A career in STEM will provide me good living standard.	Ensures a good standard living	Liaw et al. (2017)
FR6: A career in STEM will give me a financially secured future.	Ensures a financially secured future	Ahmad et al. (2015)
FR7: A career in STEM allows me to make a lot of money.	I want to make a lot of money.	Aggarwal et al. (2012)
FR8: A career in STEM pays better than other careers.	Dentistry is the best paid among the available careers.	Aggarwal et al. (2012)

There were eight items in Section 5 of Part B. This scale was used to measure students' exposure to media. The media exposure scale was developed and adapted based on Hoag et al. (2017) and Qader and Zainuddin (2011). Media exposure was measured by frequency and dose to various media sources (Hoag et al., 2017; Qader & Zainuddin, 2011). Types of media included in Hoag et al.'s (2017) survey were such as the internet and social media (e.g., Facebook). Based on this reference, an example of an item developed for this study was such as ME5 "I spend time scrolling through social media on the internet (e.g., Facebook, Twitter, Instagram, etc.)". Besides, there were four types of media used in Qader and Zainuddin's (2011) instrument: newspaper, local news stories, advertisements, and billboards. An example of an item developed based on

Qader and Zainuddin (2011) was ME2 "I spend time reading newspaper/online newspaper/e-newspaper(s)". For the purpose and context of this study, two additional types of media, books, and social networking services (e.g., WhatsApp) were added to the scale in ME3 and ME7, respectively. All items for media exposure were measured on a five-point Likert-type scale (Appendix C).

In Section 6 of Part B, career interest was measured using a five-point Likert scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). There were eight items in the career interest scale, developed from the definitions and adapted from existing scales in Ahmad et al. (2015) and Wan et al. (2014) according to the objective and context of this study (Table 3.6).

Table 3.6: Items Used to Measure Career Interest

Adapted Items	Original Items	References
CI1: I will choose a career that I find interesting.	The course is interesting. Jobs in the industry are interesting.	Ahmad et al. (2015) Wan et al. (2014)
CI2: I will choose a career that I like.	Self-developed	
CI3: I will choose a career that allows me to learn new things each day.	There are always new things to learn each day.	Wan et al. (2014)
CI4: I will choose a career that is challenging for me.	The course is challenging. Jobs in the industry are challenging.	Ahmad et al. (2015) Wan et al. (2014)
CI5: I will choose a career that is related to the subjects that I like in school.	Liked accounting subject	Ahmad et al. (2015)
CI6: I will choose a career that is related to the subjects I do well in exams.	Self-developed	

Table 3.6: Items Used to Measure Career Interest (continued)

CI7: I will choose a career that is related to the activities I like in school.	Self-developed	
CI8: It will be an interesting experience for me to meet new people at my workplace.	Meeting new people by working in the industry is a pleasant experience.	Wan et al. (2014)

3.5.3 Translation and Back Translation

This study employed a survey design using a bilingual questionnaire to test the proposed hypotheses. It was a bilingual questionnaire in English Language and Malay language (the national language of Malaysia) because the respondents were secondary school students who used both the languages as the official means of communication at schools. The back translation technique can help the researcher to ensure the quality and uniformity of translation, as well as to guarantee accuracy to reduce risk on reliability and validity (Brace, 2018; Brislin, 1970). Moreover, the MOE also requested the researcher to prepare the questionnaire in two languages, English and Malay (Appendix B2).

As such, three translators proficient in both English Language and Malay Language, and with teaching experience were involved in the translation of the questionnaire (Appendix D2). The initial draft of the questionnaire was prepared in English by the researcher. The English questionnaire was later translated into Malay Language, and subsequently translated back to English by another translator who had not read the first English questionnaire. Then, the third translator compared the translated questionnaire to the original questionnaire to ensure the meanings are accurate, and the languages used would fit Form Four secondary students' comprehension level. This translation process resulted in minor adjustments on wording and ensured an equivalence check on the bilingual questionnaire.

3.5.4 Pre-test of the Questionnaire

Brislin (1970) suggested that pre-test of the questionnaire is a useful step that can help a researcher to gauge the quality of the research instrument. According to Malhotra (2004), it is appropriate to invite academics or experts to assess an adapted and modified questionnaire. A reliability test was conducted on the original instrument so that the researcher could identify changes in the reliability of the modified instrument. Hence, 31 students were recruited to examine the internal consistency of the original instrument in pre-test. The results showed that the Cronbach's alpha values of the scales were reliable ($\alpha \geq .70$) except media exposure ($\alpha = .512$).

Hence, a panel of three experts specialised in the related fields of research were invited to review and verify the questionnaire (Appendix D1). The experts were provided with briefs on the research background, objectives, hypotheses, the definitions of the terms, and conceptual framework to establish the content and face validity of the items. The experts provided feedback and commented on the items and scales to ensure they are apt for the context of the present study and its respondents. Subsequently, the questionnaire was improved based on the experts' comments and suggestions.

Moreover, cognitive interviews were conducted prior to data collection to evaluate the quality of the questionnaire and to confirm the questionnaire was appropriate for the target sample (Beatty & Willis, 2007). As such, the main purpose of cognitive interviews in the present study was to determine if the items entailed in the questionnaire was in line with research objectives, as well as to assess the suitability of the questionnaire to collect data from secondary school students. Based on Beatty and Willis (2007), cognitive interview can help the researcher to identify underlying issues in the questionnaire that can potentially affect its quality, reliability, and validity.

Therefore, this study recruited a total of fifteen Form Four students from Peninsular Malaysia for cognitive interviews to seek their feedback on the questionnaire. With this approach, the students answered the questionnaire, and were asked about difficulties and problems they encountered while filling out the questionnaire. The students were encouraged to comment on the properties of the questionnaire, such as clarity, wording, flow, and length of questionnaire to ensure every item in the questionnaire matched their level of understanding. As a result, revisions were done to the questionnaire following the feedback provided by the students from cognitive interviews.

According to Ajzen (2002a) and Francis et al. (2004), bipolar adjectives are used in the scales of TPB to evaluate respondents' opinions of the behaviour. Bipolar adjectives are pairs of opposites that are evaluative of behaviour, such as good/bad, pleasant/unpleasant, and meaningful/worthless (Ajzen, 2002a; Francis et al., 2004). Based on the manuals, the TPB measures in the initial questionnaire was developed using a seven-point Likert scale with bipolar adjectives as shown in Figure 3.2. However, 13 out of the 15 students in the cognitive interviews commented that the scale was difficult to understand, and took them a long time to guess the meaning of unfamiliar words. Some students suggested using the standard Likert scale description "agree/disagree" to reduce difficulty in answering the questionnaire. Besides, the majority of students also pointed out that they could not differentiate the subtle difference in the seven points of the Likert scale. As a result, the TPB measures were revised to a simpler Likert scale, ranging from 1= *strongly disagree* to 5 = *strongly agree* (Figure 3.2).

Before:

	1	2	3	4	5	6	7	
Good								Bad
Pleasant								Unpleasant
Meaningful								Worthless
Unlikely								Likely
Undesirable								Desirable
Unlikely								Likely
Undesirable								Desirable
Unlikely								Likely

After:

	1	2	3	4	5	
Strongly Disagree						Strongly Agree

Figure 3.2: Revision on TPB Measures after Pre-Test

Besides, revisions were also made to the media exposure scale. Before the pre-test, the scale for media exposure was developed according to Hoag et al. (2017) and Qader and Zainuddin (2011) which measured media exposure by frequency and dose of exposure. Moreover, the media exposure items in the original questionnaire were in the form of questions instead of statements. From the pre-test, it was noted that inconsistent type of scale as compared to other measures demotivated them to answer the questionnaire honestly. More than half of the students from cognitive interviews commented that it was difficult for them to master a new type of scale which looked different from the other measures in the questionnaire, and it hindered them from answering the questionnaire smoothly. Similarly, the panel of experts also suggested that it would be appropriate to standardise the scales for all measures in Part B because the respondents were secondary school students. Consequently, the scale for media exposure was changed to a five-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), and the items were rephrased from questions to statements (Figure 3.3).

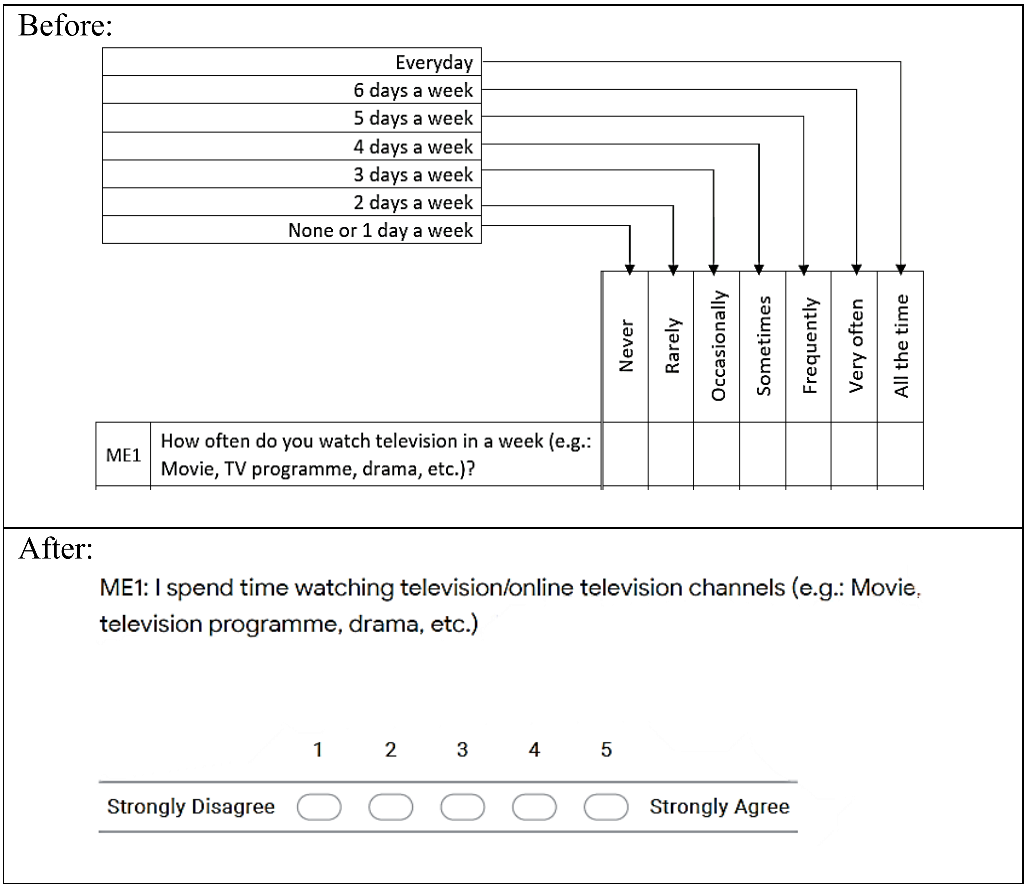


Figure 3.3: Revision on Media Exposure Scale after Pre-Test

3.5.5 Pilot Test

After the pre-test, the bilingual questionnaire comprising 55 items with five-point Likert scale was distributed online using Google Form to collect responses for a pilot test. The main purpose of the pilot test was to determine the reliability of the research instrument. As Ajzen (2002a) emphasised, it is crucial to assess the reliability of the scales to ensure its reliability by checking the internal consistency of the scales using Cronbach's alpha coefficients. Ajzen (2002a) also emphasised that the items for each scale must show high internal consistency for acceptable psychometric qualities. This can be done by reporting the Cronbach's coefficient alpha, and testing the correlation among the items (Ajzen, 2002a). The results from the tests indicated the scale had good internal consistency and the items in the scale were highly correlated with one another (further details in Chapter 4). Besides, the pilot test was also conducted using similar plans and procedures that would be carried out for the subsequent actual study to ensure the research plan and instrument were feasible.

As a result, a total of 42 responses were received online from Form Four STEM and non-STEM stream secondary school students in the Peninsular Malaysia. The responses were analysed using IBM Statistical Package for Social Sciences (SPSS) Version 23 to obtain the Cronbach's alpha values of the scales for each construct under investigation. According to Pallant (2020), a scale is considered reliable when the Cronbach's alpha value is .70 and above.

The results of the pilot study are shown in Table 3.7 below. The internal consistency coefficients obtained from the pilot test showed that all scales in the questionnaire were above the recommended threshold of .70, thus indicating good reliability. The Cronbach's alpha values of the scales in pilot test also showed improvement as compared to the pre-test. For instance, the Cronbach's alpha values of the media exposure increased from .512 (pre-test) to .862 (pilot test) after modifications as discussed in Section 3.5.4. In addition, feedback received from the pilot test indicated that all instructions and items in the questionnaire were clear and fit the comprehension level of the students. Hence, no revisions were required, and all items remained in the actual test. Table 3.7 also presents the reliability testing for the actual study (n=786; details will be discussed in Chapter 4). From the results, it was shown that the internal consistency coefficients for all the scales ranged from .801 to .948, thus the scales were also highly reliable in the actual test.

Table 3.7: Reliability of the Research Instrument

Scale	Pilot Test (n=42)		Actual Test (n=786)	
	Number of Items	Cronbach's Alpha	Number of Items	Cronbach's Alpha
Perceived Behavioural Control	6	.866	6	.906
Attitude towards Career Choice	6	.892	6	.874
Subjective Norms	15	.940	15	.946
Teachers	5	.760	5	.866
Parents	5	.879	5	.883
Friends	5	.955	5	.903
Media Exposure	8	.862	8	.801
Financial Reward	8	.934	8	.925
Career Interest	8	.900	8	.848
Career Choice Intention	4	.926	4	.948

3.6 Ethical Considerations

Consent, harm, privacy, and confidentiality are important ethical issues in social science research (Punch, 2013). It is vital to carry out research with measures to protect the participants from risks by obtaining participants' informed consent, acknowledging the potential threats, and assuring data confidentiality (Cohen et al., 2017). Prior to data collection, the researcher sought approval from the UTAR Scientific and Ethical Review Committee to conduct the research, MOE, and the state offices of education (Appendix B1).

The participants in this study are protected from the potential risks by conforming to the policies as stated in the approval letters issued by the MOE and state offices of education, as well as the university Research Ethics and Code of Conduct and Code of Practice for Research Involving Humans. Based on the terms granted by the MOE, the researcher was only permitted to recruit participants from Form Four students. This is because Form Five students had to be exempted from the study as they were under preparation for the national Malaysian Certificate of Education (Sijil Pelajaran Malaysia, SPM) exam.

The researcher obtained the parents and participants' informed and voluntary consent abide by research ethics and code of conduct through informed consent forms. For clarity, the informed consent forms for parents and respondents were also prepared in English and Malay Language. The respondents proceeded to the survey after the respondents and parents were agreeable to the terms and conditions entailed in the informed consent forms. In the consent sheets, it was noted that this study would ensure the anonymity of the respondents, and their information would be kept confidential. The purpose of the study was also explained in the consent forms for the participants and their parents. Various issues including risks, confidentiality, and potential benefits, as well as a statement of declaration by the researcher were also noted in the consent forms. It was also emphasised that the survey was on a voluntary basis, which the respondents were free to stop answering the survey and withdraw anytime without any form of loss.

3.7 Data Collection

As shown in Figure 3.4, after permissions were granted by the authorities (Appendix B), the researcher started collecting data from the respondents. At school level, the researcher first approached the schools by sending official request emails, providing the letters from the authorities. Later, the researcher sent follow-up emails or called the schools to communicate with the school clerks regarding the applications. The school clerks would usually redirect the emails or phone calls to the school principals so that the researcher could communicate with the school principals directly. In communication with the school principals, the researcher conformed to ethical terms issued by the authorities, and explained the purpose and particulars related to the study via phone calls, emails, or WhatsApp messages, subject to the school principals' requests. It was noted that there were differences in terms of practice and coordination among the schools. Some school principals assigned school counsellors, class teachers, or teachers teaching STEM subjects to be the contact persons to coordinate data collection with the researcher.

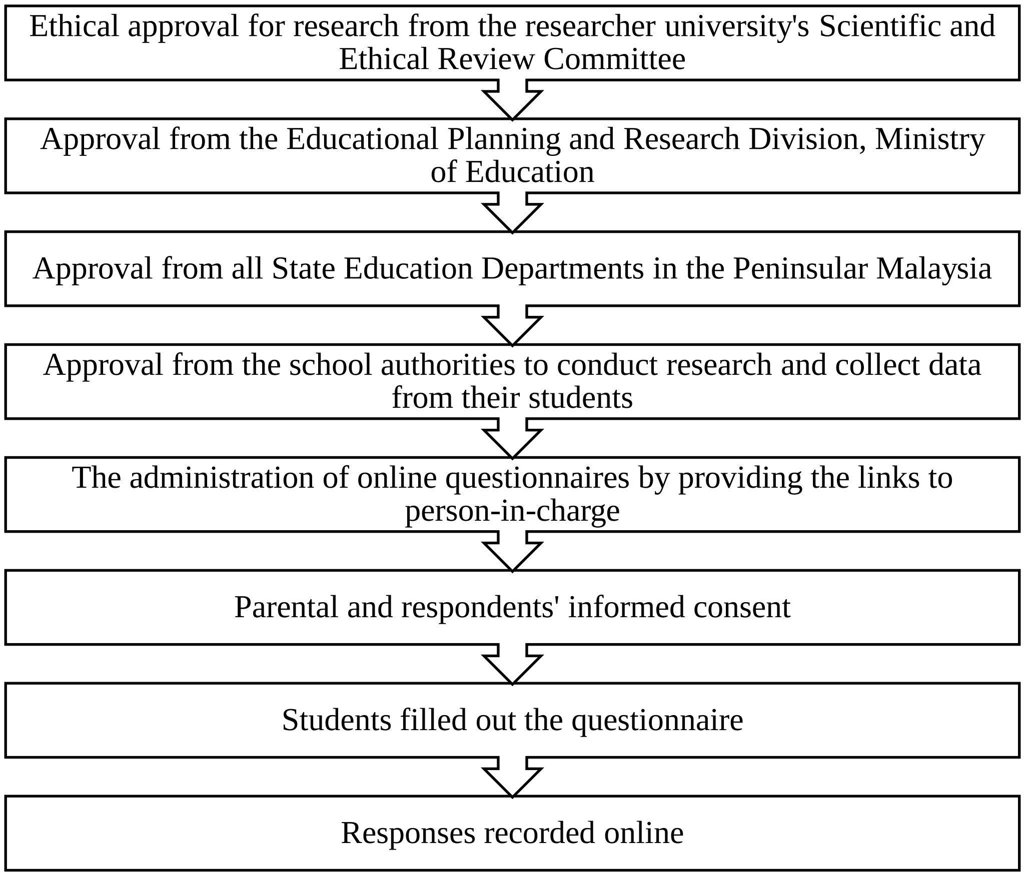


Figure 3.4: Data Collection Procedure

Both English and Malay versions of the online survey (Google Form) were sent to the school principals, teachers, or school counsellors in charge via email or WhatsApp messages. The contact persons were provided with a brief explanation on data collection to collect responses via a standardised procedure as much as possible, to reduce risks resulting from data collection. For instance, the researcher emphasised that each student was given the option to answer either the English or Malay questionnaire, whichever they preferred or understood better. Subsequently, the contact persons passed the online questionnaire links to the students to complete the survey at home so that they could seek parental consent before they were agreeable to participate in the survey. The bilingual questionnaire was administered using Google Form that requires complete responses to ensure all items are attended to reduce and avoid non-responses. In view of this, it was highlighted in the consent form to the parents and students that their participation was voluntary, and if they decide not to participate, they may leave at any time without any form of penalty or loss of benefits.

As a result, 806 sets of questionnaires with complete data were received online via Google Form with 649 (80.47%) were returned in the Malay version and 157 (19.53%) sets in the English version. According to Pallant (2020), the exclude cases listwise option includes cases with full data on all the variables needed in analysis which could limit the sample size due to removal of cases. Since the number of cases from the collected data remained adequate after removing incomplete cases and retaining only cases with full data, exclude cases listwise was selected for the subsequent analyses in this study.

3.8 Data Analysis Plan

Data analysis is a key step in a research study to examine the measured variables and their relationships. As quantitative data were collected in the present study, statistical approaches were employed to analyse data to answer the research questions. Therefore, descriptive analyses would be done using IBM SPSS Version 23 to obtain statistics for preliminary tests and demographic information, whereas inferential analyses would be performed using Analysis of Moment Structures (AMOS) Version 23 for inferential analyses to test the hypotheses.

There were three purposes of descriptive analyses in this study. Firstly, descriptive statistics would be obtained to generate a numerical overview of the respondents' demographic information. This helped the researcher and the audience to have a clearer understanding of the characteristics of the participants, and context of the study. Secondly, preliminary analyses on missing data, outliers, normality, linearity, and multicollinearity would be conducted to obtain accurate and reliable data for subsequent inferential analyses. Besides, descriptive statistics were also generated to manifest the frequency, percentage, mean and standard deviation of the variables investigated in this study using IBM SPSS.

Aligned with the main objective of this purpose, this study aimed to investigate factors that influence secondary school students' intention to choose a career in STEM through the TPB. Hence, the research hypotheses were postulated based on each specific objective. Table 3.8 shows the statistical analyses used in each corresponding specific objective in the present study.

Table 3.8: Statistical Analyses Used in this Study

Objectives and Hypotheses		Statistical Analyses
Objective 1: To develop a model to predict antecedents that influence secondary school students' intention to choose a career in STEM.		SEM
H1	Perceived behavioural control has a significant influence on career interest.	
H2	Perceived behavioural control has a significant influence on career choice intention.	
H3	Attitude towards career choice has a significant influence on career interest.	
H4	Attitude towards career choice has a significant influence on career choice intention.	
H5	Subjective norms have a significant influence on career interest.	

Table 3.8: Statistical Analyses Used in this Study (continued)

H6	Subjective norms have a significant influence on career choice intention.	
H7	Subjective norms have a significant influence on attitude towards career choice.	
H8	Media exposure has a significant influence on career interest.	
H9	Media exposure has a significant influence on career choice intention.	
H10	Media exposure has a significant influence on attitude towards career choice.	
H11	Financial reward has a significant influence on career interest.	
H12	Financial reward has a significant influence on career choice intention.	
H13	Career interest has a significant influence on career choice intention.	
Objective 2:	To examine the role of mediators (attitude towards career choice and career interest) for secondary school students' intention to choose a career in STEM.	SEM (Mediation)
H14	Attitude towards career choice mediates the influence of subjective norms on career interest.	
H15	Attitude towards career choice mediates the influence of subjective norms on career choice intention.	
H16	Attitude towards career choice mediates the influence of media exposure and career interest.	
H17	Attitude towards career choice mediates the influence of media exposure and career choice intention.	
H18	Career interest mediates the influence of perceived behavioural control on career choice intention.	
H19	Career interest mediates the influence of attitude towards career choice on career choice intention.	
H20	Career interest mediates the influence of subjective norms on career choice intention.	
H21	Career interest mediates the influence of media exposure on career choice intention.	
H22	Career interest mediates the influence of financial reward on career choice intention.	
Objective 3:	To test whether secondary school students' streams of study (STEM and non-STEM) act as the moderator for their intention to choose a career in STEM.	SEM (Multigroup Analysis)
H23	The streams of study (STEM and non-STEM) moderate students' career choice intention in STEM.	

Data collected in this research would be analysed using SEM to investigate the antecedents influencing the career choices of secondary school students from Peninsular Malaysia in STEM. In order to obtain inferential statistics, SEM with AMOS would be adopted to examine relationships between the observed and latent variables as proposed in the hypotheses.

According to Hair et al. (2010), SEM is an assortment of statistical techniques that permits a set of relations among variables to be examined. This means that the relationships between one or more exogenous variables and endogenous variables can be assessed using this multivariate data analysis (Ullman, 2013). Both exogenous variables (independent variables) and endogenous variables (dependent or mediating variables) can be either observed or latent variables. Table 3.9 below shows the exogenous and endogenous variables used in this study.

Table 3.9: Dependence Relationship between the Variables

Endogenous Variables	Exogenous/ Endogenous Variables
Attitude towards Career Choice	Subjective Norms, Media Exposure
Career Interest	Perceived Behavioural Control, Attitude towards Career Choice, Subjective Norms, Media Exposure, Financial Reward,
Career Choice Intention	Perceived Behavioural Control, Attitude towards Career Choice, Subjective Norms, Media Exposure, Financial Reward, Career Interest

SEM allows researchers to assess and modify theoretical models and offers great flexibility in hypothesis testing with any combination of observed or latent variables as predictors in research models (Hair et al., 2010; Kline, 2015; Ullman, 2013). It is also widely used for its advantage in that it considers model measurement error in the estimation process (Hair et al., 2010; Kline, 2015). SEM is a powerful statistical tool that can define a model with underlying theories, and test the model fit through measurement model and structural model (Kline, 2015). In this study, AMOS Version 23 would be used to perform SEM as it allows the researcher to generate comprehensive model illustrations (Ullman, 2013).

In SEM, the construct validity, convergent validity and discriminant validity of the proposed research model would be assessed using computing fitness indices (Hair et al., 2010). Hence, a two-step approach involving the measurement model and the structural model is recommended (Anderson & Gerbing, 1988). The two-step approach is useful to avoid interactions that potentially occur between the constructs during model testing (Kline, 2015). Hence, the two-step approach was employed in present study to assess the hypotheses and proposed model.

A measurement model is established with confirmatory factor analysis (CFA) to assess how well the latent indicators are associated with the observed variables (Hair et al., 2010). At this step, the focus is to verify the unidimensionality, and establish the convergent and discriminant validities of the constructs (Ramayah et al., 2016). This is an important step to ensure reliability and validity before a structural model can be developed. Subsequently, the structural model would be tested, and the results of path analyses would be presented at this step in line with the hypothesised relationships between the endogenous and exogenous variables based on the research hypotheses.

In particular, Hair et al. (2010) recommended there should be at least three indicators in one congeneric measurement model, and this would offer sufficient degree of freedom in estimating the parameters of the model. The researcher also ensured unidimensionality of a construct by establishing the inter-item correlation of an item with other items under the same construct. According to Hair et al. (2010), it is reasonable to retain the items with correlation values between .30 and .90. Otherwise, it is appropriate to reassess or remove the items which correlate below or beyond the recommended range from the construct.

Besides, convergent validity can be determined by evaluating the factor loadings, average variance extracted (AVE), and composite reliability (CR). It was suggested in Hair et al. (2010) that factor loadings are ideal above .70, but it is also acceptable at .60 and above. Meanwhile, the values for AVE and CR should be at least .50 and .70 respectively to establish adequate convergent validity. Discriminant validity is also another important aspect that should be assessed to determine if a construct differs from other constructs being measured (Hair et al., 2010). Based on Hair et al. (2010), the AVE values should be greater than the corresponding inter-construct squared correlation estimates to ensure each individual item represents one latent construct.

In the assessment of model validity, a set of goodness-of-fit (GOF) criteria was set to evaluate how well a theory fits the data (Hair et al., 2010; Tabachnick & Fidell, 2019). To test model fit, Hair et al. (2010) recommended researchers to assess at least one index from each category of these fit measures:

absolute (goodness-of-fit index [GFI]; Root mean square error of approximation [RMSEA]), incremental (Tucker-Lewis index [TLI]; comparative fit index [CFI]), and parsimonious (normed chi-square [χ^2/df]). These indices serve as the criteria to determine the fit of measurement and structural models together with Chi-square and degree of freedom (Hair et al., 2010).

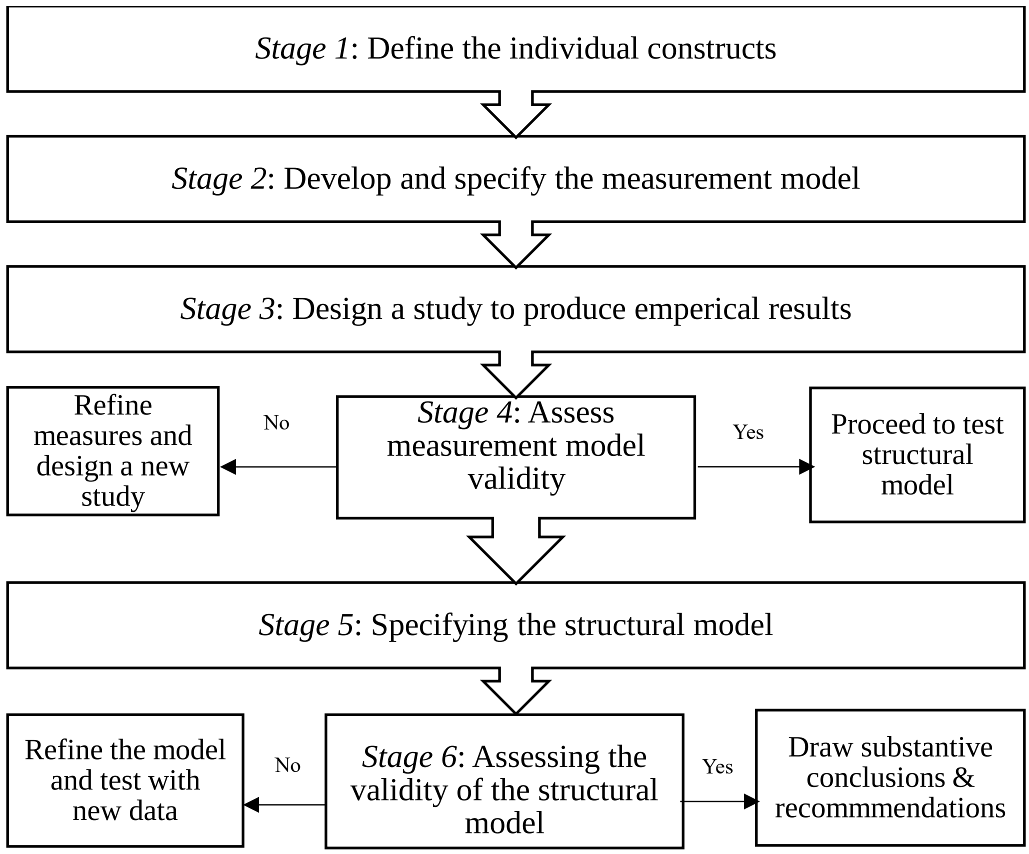
It was highlighted in Hair et al. (2010) that the indices are particularly vital in determining the fit of a structural model because significant paths can only be measured when model fit is achieved. In contrast, when a model is not valid, improvements can be made to the model by diagnosing the modification indices (Hair et al., 2010). It is appropriate to improve model fit when modification indices are above 4 (Hair et al., 2010). Table 3.10 displays the GOF indices that would be used in the assessment of model fit in Chapter 4.

Table 3.10: Goodness-of-Fit Indices Used in This Study

Fit Indices	Recommended cut-offs[a]	Descriptions
Goodness-of-fit index (GFI)	> 0.90	• 0 indicates poor fit • 1 indicates perfect fit
Root mean square error of approximation (RMSEA)	≤ 0.80	• < 0.05 indicates perfect fit • 0.05-0.08 indicates acceptable fit
Tucker-Lewis index (TLI) & comparative fit index (CFI)	> 0.90	• 0 indicates poor fit • 1 indicates perfect fit
Normed chi-square (χ^2/df)	1.00-5.00	• < 3.00 is ideal • up to 5 is acceptable

[a]The desired range of values for a good fit based on Hair et al. (2010).

Overall, this study employed the Hair et al.'s (2010) six stages of SEM to assess the proposed model (Figure 3.5). Besides, the statistical significance level was set at .05 throughout the study.



Note. The six stages of SEM according to Hair et al. (2010).

Figure 3.5: Six Stages in SEM

3.9 Concluding Remarks

In summary, this chapter delineated the research paradigm and design, as well as the methods that would be conducted in this study. The research instrument was a pre-tested and pilot-tested bilingual questionnaire that were distributed online using Google Form. Proportional stratified cluster sampling was used to recruit the respondents who were Form Four STEM and non-STEM students from the Peninsular Malaysia. As a result, 806 responses were received, and the collected data would be used for descriptive and inferential analyses in Chapter 4 using IBM SPSS and AMOS Version 23.

CHAPTER 4

RESULTS AND FINDINGS

4.1 Introduction

This chapter presents the results and findings of the study to answer the research questions and hypotheses. Chapter 4 begins with the preliminary analyses including the inspection of missing values, the identification of outliers, and testing of statistical assumptions. The successive section provides a statistical description on the respondents' demographic information such as gender and location of schools. The results generated from using statistical tools (IBM SPSS and AMOS) are outlined systematically in the last section of this chapter. In Section 4.4, the results and findings are presented to answer the research objectives (a) to develop a model to predict antecedents that influence secondary school students' intention to choose a career in STEM, (b) to examine the role of mediators for secondary school students' intention to choose a career in STEM, and (c) to test whether secondary school students' streams of study (STEM and non-STEM) act as a moderator for their intention to choose a career in STEM.

4.2 Preliminary Analyses

In this study, inspection of missing values, the identification of outliers, and testing of statistical assumptions were done prior to the multivariate analysis (Hair et al, 2010). The online survey in both English and Malay versions were sent to the teachers or school counsellors in charge. The contact persons subsequently passed the online questionnaire to the students to complete the survey at home so that they could seek parental consent. The students were given the freedom to answer any one version of the bilingual questionnaire that they were comfortable with for accurate responses. A total of 806 sets of questionnaires were received online via Google Form with 649 (80.47%) were returned in the Malay version, and 157 (19.53%) sets in the English version.

Firstly, the data were inspected manually via case processing summary to ensure there were no missing values. Missing data was not detected because the questionnaires were distributed using Google Form which allowed the researcher to request complete responses from the participants. In the Google Form, the survey was preceded by parental and respondent consent forms which the respondents were required to sign if they wished to join the survey. The respondents were allowed to leave the Google Form and decline to submit the survey anytime if they did not want to or could not sign the consent or complete the survey. Based on the available population, the Google Form was distributed to all participating schools until the desired target sample size was reached (Appendix A2).

As a result, 806 sets of questionnaires with complete data were used for the preliminary analyses. According to Pallant (2020), the exclude cases listwise option includes cases with full data on all the variables needed in analysis which could limit the sample size due to removal of cases. Since the number of cases with full data from the collected data remained adequate after inspection, exclude cases listwise was selected for the subsequent analyses in this study.

Besides, exploratory data analysis (EDA) was carried out in the preliminary analysis to identify the outliers in the data collected from the survey. According to Pallant (2020), this step is necessary because many statistical techniques used for analyses are sensitive to outliers. Indeed, outlying residuals are rather common when the sample size is large (Hair et al., 2010; Pallant, 2020). At this stage, it is recommended to inspect if there are any extreme outliers via EDA and remove them from the data file. The detected outliers could be removed or retained by further assessing the data in the upcoming tests. The extreme outliers can be identified from the boxplot in the output of the analysis where the extreme points are indicated with an asterisk (Pallant, 2020). Based on the results from EDA, there was no extreme outlier in this study. Hence, none of the data was removed and all 806 cases were retained for further inspection in the preliminary tests.

According to Hair et al. (2010), outliers in the multivariate test indicate they are only unique in combination but not in any single variable. Hence, Mahalanobis D^2 was used to detect multivariate outliers in avoid potential problems in the subsequent analyses. The critical value used in the assessment of multivariate outliers in this study was 27.88 with the threshold significance value of .001 (Hair et al., 2010; Tabachnick & Fidell, 2019). Among the 806 cases, 20 exceeded the critical value based on the results from the multiple regression analysis, thus they were removed from this study. Hence, the actual sample size was reduced to 786 (345 STEM students and 441 non-STEM students) after the removal of multivariate outliers.

The purpose of assessing common method bias was to ensure variance is not attributed by measurement method because it could be a threat to measurement validity when common method variance is high (Podsakoff et al., 2012). According to Podsakoff et al. (2012), this issue can be addressed by taking procedural remedies during survey development and conducting statistical diagnosis after data collection. As detailed in Chapter 3, the research instrument used in this study was carefully pre-tested, translated, validated by experts, and pilot tested to avoid ambiguity and maximise clarity in the questionnaire. Moreover, it was emphasised in the informed consent sheets that the responses were anonymous, and the respondents would not be identified individually. This step is considered a procedural remedy that could help to reduce socially desirable responses (Podsakoff et al., 2012). Besides, Harman's one factor test was conducted using unrotated exploratory analysis to ensure the variance was below 50% (Podsakoff et al., 2012). From the results (Appendix E1), the largest factor accounted for 38% of variance, thus there was no common method bias issue in this study. Based on Bagozzi et al. (1991), high correlations among constructs (> .90) suggested potential presence of common method variance. As displayed in Table 4.1, the correlations among the constructs in this study ranged between .38 and .75. Hence, there is no issue of common method bias in this study.

Table 4.1: Correlations among the Constructs

Constructs	ACC	PBC	SN	ME	FR	CI	CCI
ACC	1.00						
PBC	.70	1.00					
SN	.69	.73	1.00				
ME	.40	.40	.42	1.00			
FR	.61	.55	.63	.38	1.00		
CI	.57	.47	.52	.50	.56	1.00	
CCI	.69	.69	.75	.40	.52	.49	1.00

Note. ACC: Attitude towards Career Choice; PBC: Perceived Behavioural Control; SN: Subjective Norms; ME: Media Exposure; FR: Financial Reward; CI: Career Interest; CCI: Career Choice Intention.

In the preliminary assessments, the sample size was checked to ensure it is appropriate for the subsequent multivariate analyses. The actual sample size was reduced to 786 after the removal of multivariate outliers. There were 345 students from the STEM stream and 441 students from the non-STEM stream. As shown in Table 4.2, the number of students was proportionally represented with the ratio (44:56) that reflected the population of students from STEM (44%) and non-STEM (56%) streams in Malaysia. Hence, the actual sample was adequate and apt to be used for the upcoming analyses as it exceeded the calculated sample size.

Table 4.2: The Calculated and Actual Samples

Peninsular Malaysia	Strata			
	Calculated Sample		Actual Sample	
	STEM	Non-STEM	STEM	Non-STEM
Selangor	46	45	89	87
Federal Territory of Kuala Lumpur	11	11	22	20
Federal Territory of Putrajaya	1	1	2	2
Johor	26	36	46	69
Negeri Sembilan	9	12	18	24
Melaka	7	9	14	18
Perak	19	23	38	45
Kedah	14	23	28	45
Pulau Pinang	12	14	24	28
Perlis	2	3	4	6
Kelantan	11	19	22	38
Pahang	9	16	18	32
Terengganu	10	14	20	27
Subtotal	177 (44%)	226 (56%)	345 (44%)	441 (56%)
Total	400 (100%)		786 (100%)	

Furthermore, it is also important to ensure the variables do not violate the assumptions before carrying out any statistical techniques to address the research questions (Hair et al., 2010; Pallant, 2020). Statistical assumptions assessed in this study included normality, linearity and multicollinearity. Testing of assumptions also allows the researcher to obtain descriptive statistics including mean, standard deviation, skewness and kurtosis of the variables used in this study (Pallant, 2020).

Normality test is an important assumption test in multivariate analysis to ensure normal data distribution for each individual variable (Pallant, 2020). The normality of the distribution of scores was assessed in a test of normality via Kolmogorov-Smirnov statistics. Hair et al. (2010) recommended Kolmogorov-Smirnov statistics for research with a large sample size which involves over 50 participants. A non-significant result with *p*-value over .05 indicates normality, while a significant result with *p*-value less than .05 suggests the violation of the assumption of normality (Pallant, 2020). In the test of normality of this study, the results showed that all variables had *p*-value less than .05, suggesting the mean for all the variables were not normal. According to Hair et al. (2010) and Pallant (2020), it is common to find the non-significant results in the Test of Normality in large samples.

Besides, visual methods were also used to assess normality. Visual inspection of the distribution using histogram, normal Q-Q plot, detrended normal Q-Q plot and boxplot were conducted in this study. From the illustrations (Appendix E2), financial reward and career interest were found to be skewed. Hence, further assessment on descriptive statistics were carried out to determine the distribution of mean for the variables.

It was suggested that the values of skewness and kurtosis in descriptive statistics offer useful information regarding the distribution of scores on variables (Pallant, 2020). Skewness indicates the symmetry of distribution, whereas kurtosis provides an indication on the pointiness of the distribution of scores (Pallant, 2020). Based on Table 4.3, skewness values ranged from -0.77 to -0.22, while kurtosis values ranged from -0.34 to 0.66. The descriptive statistics showed that the values of skewness and kurtosis were within the accepted range of ±2.58 for sample size over 200 (Ghasemi & Zahediasl, 2012). Therefore, the distribution of mean for each variable in this fulfilled the normality assumptions. Besides, it was found that there were several outliers in the visual illustrations. Pallant (2020) recommended to compare the trimmed mean and original mean values for each variable to check if the outlying cases are problematic. If the trimmed mean and mean values are similar, the cases can be retained (Pallant, 2020). As shown in Table 4.3, the values between the trimmed mean and original mean are very similar, hence it can be assumed that the outliers are not problematic and can be retained in this study (Pallant, 2020).

Table 4.3: Descriptive Statistics for Normality

Scale	Min	Max	5% Trimmed Mean	Mean	*SD*	Skewness	Kurtosis
PBC	1.00	5.00	3.50	3.47	0.84	-0.23	-0.15
ACC	1.00	5.00	3.84	3.81	0.77	-0.40	0.17
SN	1.00	5.00	3.59	3.57	0.81	-0.22	-0.34
ME	1.00	5.00	3.63	3.62	0.72	-0.33	0.20
FR	1.00	5.00	3.98	3.94	0.76	-0.50	0.08
CI	1.13	5.00	4.11	4.08	0.67	-0.77	0.66
CCI	1.00	5.00	3.66	3.61	0.98	-0.42	-0.15

Note. PBC: Perceived Behavioural Control; ACC: Attitude towards Career Choice; SN: Subjective Norms; ME: Media Exposure; FR: Financial Reward; CI: Career Interest; CCI: Career Choice Intention.

Linearity was assessed using scatterplots to explore the relationship among the variables in this study. According to Pallant (2020), this is useful to check whether the residuals possess a straight-line relationship with the dependent variable values to indicate linearity. In other words, when there is no straight line between the variables, the scatterplot is in curvilinear fashion. Hence, linearity assumption is only fulfilled and considered suitable for correlation analyses when two variables are related linearly (Pallant, 2020; Tabachnick & Fidell, 2019). Matrix scatter plots were assessed to inspect if the slopes among the variables are linear. From the results (Appendix E3), the slope of the variables in the matrix scatter plots was linear, indicating the relationship among the variables was linear. Therefore, the linearity assumption was fulfilled, and it would be appropriate to further conduct Pearson product-moment correlations for the variables to assess multicollinearity.

It is necessary to ensure there are at least some relationships among the variables in the model (Pallant, 2020). According to Hair et al. (2010), multicollinearity is present when one independent variable highly correlates with another independent variable. This occurs when collinearity between the variables calculated by the Pearson's correlation coefficient is .90 and above (Hair et al., 2010; Pallant, 2020). As there are multiple predicting variables in multivariate analyses, it is important to check for multicollinearity among the variables. This is to ensure the variables are not highly correlated which would indicate one construct can be explained by another construct in the analysis (Hair et al., 2010). It was reported in the results of multicollinearity (Table 4.1) that all the Pearson's correlation coefficient values were all below .90.

Besides, multicollinearity was also evaluated via tolerance and variance inflation factor (VIF) in this study. Tolerance refers to how much of the variability of one independent variable is not explained by other independent variables in a model (Pallant, 2020). The recommended cut-off value for tolerance to identify multicollinearity is below .10 which suggests high multiple correlations between variables. On the other hand, VIF represents the inversion of tolerance, hence VIF values above 10 indicate multicollinearity (Pallant, 2020). The results in Table 4.4 show that all tolerance values were above .10 and all VIF values were below 10. It can be concluded that no high bivariate correlation was present among the variables in this study, thus the multicollinearity assumption was not violated in this study.

Table 4.4: Collinearity Statistics

Constructs	Tolerance	VIF
Attitude towards Career Choice	.39	2.59
Perceived Behavioural Control	.38	2.64
Subjective Norms	.32	3.10
Media Exposure	.69	1.45
Financial Reward	.30	3.30
Career Interest	.53	1.89

Note. Dependent Variable: CCI.

4.3 Demographic Information

Demographic information of the respondents in this study is detailed in this section to better understand the backgrounds and characteristics of the respondents. The demographic details on the distribution of respondents described in this section include age, gender, streams of study (STEM or non-STEM) and location of schools.

All respondents in this study were 16-year-old adolescents from Peninsular Malaysia. The respondents were upper secondary school students at Form Four. Table 4.5 shows the distribution of respondents in this study by gender. Among the 786 respondents, there were more females than males in which 484 (61.60%) were females while another 302 (38.40%) were males.

Table 4.5: Distribution of Respondents by Gender

Gender	Frequency	Percentage (%)
Female	484	61.60
Male	302	38.40
Total	786	100

As mentioned in the previous chapter, the number of students in each stream of study and state was calculated proportionately based on the population in each state of Peninsular Malaysia. Table 4.6 presents the distribution of respondents' streams of study according to the location of schools. The respondents were students from the Peninsular Malaysia that consists of the Central Region, Southern Region, Northern Region and the East Coast. Students from the Central Region (32.75%) constituted most of the respondents from the STEM stream, followed by students from the Northern Region (27.25%), Southern Region (22.61%) and the East Coast (17.39%). On the other hand, participants from the non-STEM stream were rather evenly distributed across the four regions. Respondents from the Northern Region contributed to 28.11% of the non-STEM students participated in this study, followed by Southern Region (25.17%), Central Region (24.72%), and the East Coast (22.00%).

Table 4.6: Distribution of Respondents' Streams of Study by Location of Schools

Location of Schools	STEM Stream		Non-STEM Stream	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Central Region	*113*	*32.75*	*109*	*24.72*
Selangor	89	25.80	87	19.73
Federal Territory of Kuala Lumpur	22	6.38	20	4.54
Federal Territory of Putrajaya	2	0.58	2	0.45
Southern Region	*78*	*22.61*	*111*	*25.17*
Johor	46	13.33	69	15.65
Negeri Sembilan	18	5.22	24	5.44
Melaka	14	4.06	18	4.08
Northern Region	*94*	*27.25*	*124*	*28.11*
Perak	38	11.01	45	10.20
Kedah	28	8.12	45	10.20
Pulau Pinang	24	6.96	28	6.35
Perlis	4	1.16	6	1.36
East Coast	*60*	*17.39*	*97*	*22.00*
Kelantan	22	6.38	38	8.62
Pahang	18	5.22	32	7.26
Terengganu	20	5.80	27	6.12
Total	345	100	441	100

4.4 Structural Equation Modelling

SEM is used to explain the relationships among multiple constructs by assessing the interrelationships in the structure that involves a series of equations (Hair et al., 2010). Prior to assessing how well a theory fits the reality as represented by data used in this study, the researcher should first express the fundamental theory in terms of relationships among the measure variables and latent constructs (Hair et al., 2010). In line with the main research objective of this study, SEM was used to develop a model that entails factors influencing secondary school students' intention to choose a career in STEM using TPB.

The six-stage decision process in SEM (Figure 3.5) was applied in this study to assess how well the theory would fit the reality as represented by the obtained data (Hair et al., 2010). The six stages are: Defining individual constructs (Stage 1), developing the overall measurement model (Stage 2), designing a study to produce empirical results (Stage 3), assessing the measurement model validity (Stage 4), specifying the structural model (Stage 5), and assessing the structural model validity (Stage 6). Based on Objective 1, the six stages will be presented in detail systematically in Chapter 4.4.1 to examine the influence of predictors on the model measuring career choice intention. SEM statistical results reporting style by Moses (2012) and Cham (2016) were referred to as the guide to report and write the results of this study.

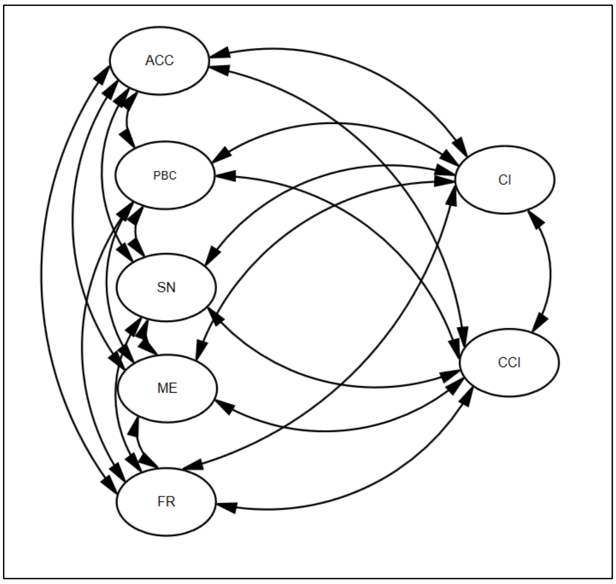
Results generated using SEM are presented in Chapter 4.4.2 in correspondence to Objective 2 to examine the role of mediators for secondary school students' intention to choose a career in STEM. In this section, the mediators in discussions are attitude towards career choice and career interest. The mediating roles of the two proposed variables in the model will be presented with statistical evidence generated from SEM. Lastly, it was hypothesised in Objective 3 that students' streams of study would moderate their career choice intention in STEM. SEM was also used to test whether STEM and non-STEM streams act as a moderator for students' career choice (Chapter 4.4.3).

4.4.1 The Influence of Predictors on the Model Measuring Career Choice Intention in STEM

According to Table 3.8, SEM was used to test the first research objective, that is to develop a model to predict antecedents that influence secondary school students' intention to choose a career in STEM. Hence, the overall model fit between the proposed research model (Figure 2.3), and the obtained data of predicted factors on career choice intention was tested using SEM.

Stage 1: Defining Individual Constructs. Firstly, according to Hair et al. (2010), a good measurement theory is crucial to obtain useful results from hypotheses tests via SEM. According to the review of literature, six antecedents were hypothesised as the key constructs that could influence students' STEM career choice intention in this study. The factors were perceived behavioural control, attitude towards career choice, subjective norms (teachers, parents and friends), media exposure, financial reward, and career interest.

Stage 2: Developing the Overall Measurement Model. In stage 2, the measurement model should be specified. Figure 4.1 represents the overall measurement model of the latent variables involved in this research, with correlational relationships between constructs. The measurement model for each latent variable will also be represented with an independent diagram. Likewise, the three subscales under subjective norms, namely teachers, parents and friends will also be identified separately. Each latent construct to be included in the model should be identified and the measured indicators should be assigned to the respective latent constructs (Hair et al., 2010). The measurement model tested in this study was specified and developed in which there were seven latent variables and a total of 55 items in the instrument.



Note. ACC: Attitude towards Career Choice; PBC: Perceived Behavioural Control; SN: Subjective Norms; ME: Media Exposure; FR: Financial Reward; CI: Career Interest; CCI: Career Choice Intention.

Figure 4.1: Overall Measurement Model

Table 4.7 represents the measurement model for the seven constructs in this study. Each measurement model is depicted in an independent diagram with the indicators associated with each respective construct. According to the rule of thumb in Hair et al. (2010), each variable should have a minimum of three indicators. As shown in Table 4.7, there are four to eight indicators per construct, suggesting the number of indicators is adequate for all the measurement models. An evaluation of the proposed overall measurement model was conducted by building the one-factor congeneric models for each construct to estimate the factor loadings of each item. The retention of items was based upon the significant factor loadings and GOF indices as noted in Chapter 3.

Table 4.7: Measurement Model Developed for Each Construct

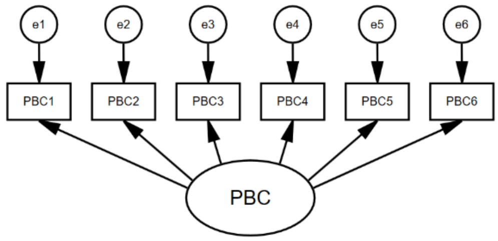
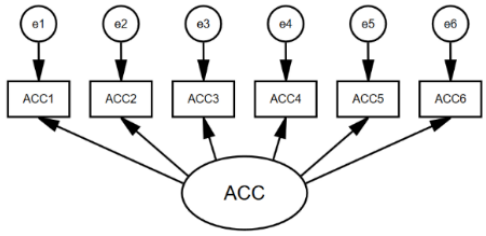
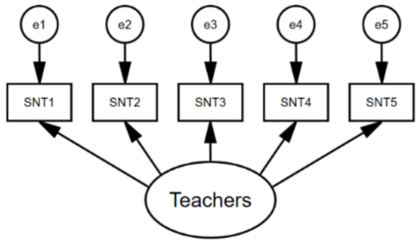
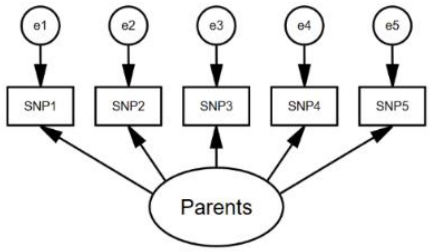
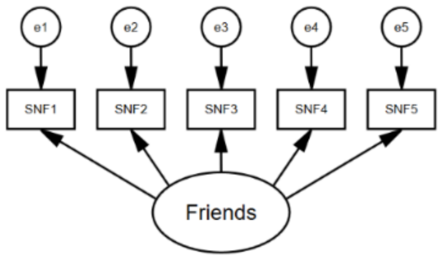
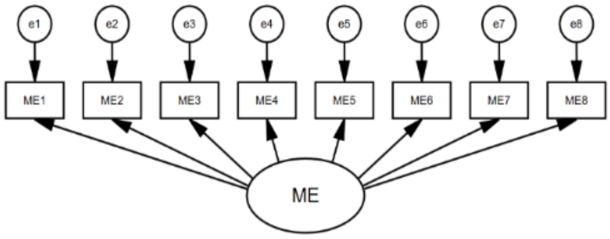
<table>
<tr><th>Construct</th><th>Measurement Model</th><th>Latent Variable</th></tr>
<tr><td>Perceived Behavioural Control</td><td>
</td><td>6 measured indicators</td></tr>
<tr><td>Attitude Towards Career Choice</td><td>
</td><td>6 measured indicators</td></tr>
<tr><td rowspan="3">Subjective Norms</td><td>(a) Teachers

</td><td>5 measured indicators</td></tr>
<tr><td>(b) Parents

</td><td>5 measured indicators</td></tr>
<tr><td>(c) Friends

</td><td>5 measured indicators</td></tr>
</table>

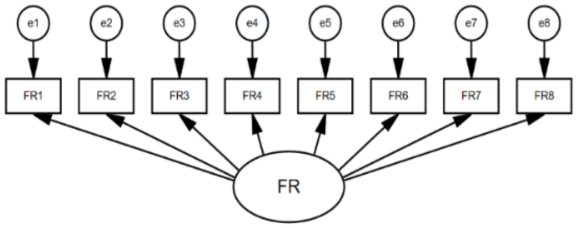
Table 4.7: Measurement Model Developed for Each Construct (continued)

Media Exposure



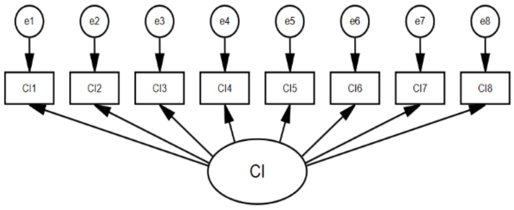
8 measured indicators

Financial Reward



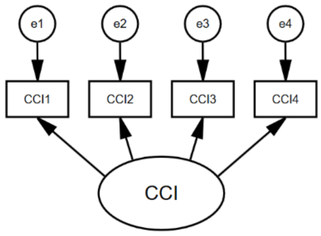
8 measured indicators

Career Interest



8 measured indicators

Career Choice Intention



4 measured indicators

Stage 3: Designing a Study to Produce Empirical Results. The focus of this research was to collect information regarding the factors that influence career choice intention in STEM among Form Four students' secondary school in the Peninsular Malaysia. The collected data were screened, and potential problematic outliers were identified and eliminated via EDA in the previous section. Hair et al. (2010) suggested that maximum likelihood estimation procedure in SEM requires a sample size larger than 50. The final sample size in this research was 786 which included 345 STEM students and 441 non-STEM students. The sample size used in this research was considered sufficient for the subsequent analyses and maximum likelihood estimation. Hence, maximum likelihood estimation was set as the default estimation procedure in this research.

Stage 4: Assessing Measurement Model Validity. As noted in Chapter 3.8, the model fit indices used in this study to assess the measurement model were GFI, TLI, CFI, RMSEA, and χ^2/df. As Hair et al. (2010) suggested, a model is regarded fit when the values of GFI, TLI and CFI exceed .90. Besides, values of RMSEA .08 and below .08, and χ^2/df between 1 to 5 is acceptable while below 3 would be ideal for a good fit (Hair et al., 2010; Kline, 2015). As mentioned in the earlier chapter, the following criteria must be met to achieve convergent validity: (a) Items with factor loading of at least 0.60 should be retained, (b) CR for the variables should score 0.70, and (c) AVE values should be at least 0.50 (Hair et al., 2010).

There were six items in the construct measuring perceived behavioural control (*M* = 3.49, *SD* = 0.84). Table 4.8 reports on perceived behavioural control in STEM career choice. Three out of the six items in this construct were above the overall mean. PBC6 "It is under my control to choose a career in STEM" scored the highest mean (*M* = 3.59, *SD* = 1.03). It is followed by PBC1 "I am confident I will be able to choose a career in STEM" (*M* = 3.57, *SD* = 1.00) and PBC3 "I expect myself to have the ability to choose a career in STEM" (*M* = 3.50, *SD* = 0.99). On the other hand, items PBC5 (*M* = 3.47, *SD* = 1.03), PBC4 (*M* = 3.43, *SD* = 0.97) and PBC2 (*M* = 3.36, *SD* = 1.07) scored below the overall mean.

Table 4.8: Descriptive Statistics for Perceived Behavioural Control

	Item	*M*	*SD*
PBC1	I am confident I will be able to choose a career in STEM.	3.57	1.00
PBC2	I think it is easy for me to choose a career in STEM.	3.36	1.07
PBC3	I expect myself to have the ability to choose a career in STEM.	3.50	0.99
PBC4	I have good ability to choose a career in STEM.	3.43	0.97
PBC5	I have the self-confidence to choose a career in STEM.	3.47	1.03
PBC6	It is under my control to choose a career in STEM.	3.59	1.03

Table 4.9 shows the inter-item correlation matrix for perceived behavioural control. The maximum correlation of an item with at least one of the items was .30 < r <.90. From the table presented below, all the items in this construct correlated adequately.

Table 4.9: Inter-item Correlation for Items in Perceived Behavioural Control

	PBC1	PBC2	PBC3	PBC4	PBC5	PBC6
PBC1	1.00					
PBC2	.67	1.00				
PBC3	.67	.66	1.00			
PBC4	.69	.68	.77	1.00		
PBC5	.68	.57	.67	.76	1.00	
PBC6	.50	.47	.49	.52	.51	1.00

The initial measurement model of perceived behavioural control offered a poor fit with χ^2/df > 5.00 and RMSEA > .08. The factor loadings for all items in perceived behavioural control exceeded the threshold of .60, except PBC6. Hence, PBC6 was removed, and the model was improved by stabilising the error variances (e1 and e2, e2 and e5, e3 and e5). As a result, all items in this construct met the requirement for convergent validity as all items loaded more than .60 with AVE measure exceeded .50 (.70) and CR exceeded .70 (.92). Five items (PBC1 to PBC5) were retained in the perceived behavioural control construct with GFI, TLI and CFI > .90, RMSEA < .08, and χ^2/df < 3.00.

There were six items in the construct measuring students' attitude towards their choice of career in STEM. Table 4.10 shows attitude towards STEM career choice among Form Four students in Peninsular Malaysia. Based on the results, the overall mean for the attitude towards career choice construct was 3.81 with a standard deviation of 0.77. Four out of the six items in this construct were above the overall mean. ACC1 "A career in STEM is good" scored the highest mean (*M* = 4.00, *SD* = 0.99), followed by ACC4 (*M* = 3.84, *SD* = 1.02), ACC5 (*M* = 3.84, *SD* = 1.02) and ACC6 (*M* = 3.83, *SD* = 1.05). Meanwhile, ACC2 (*SD* = 0.97) and ACC3 (*SD* = 0.99) scored the same lowest mean with the value of 3.68.

Table 4.10: Descriptive Statistics for Attitude towards Career Choice

	Item	*M*	*SD*
ACC1	A career in STEM is good.	4.00	0.99
ACC2	A career in STEM will make me feel good.	3.68	0.97
ACC3	A career in STEM will make me happy.	3.68	0.99
ACC4	A career in STEM is meaningful to me.	3.84	0.91
ACC5	A career in STEM will bring me respect.	3.84	1.02
ACC6	A career in STEM makes me feel proud.	3.83	1.05

The inter-item correlation matrix is presented in Table 4.11. The maximum correlation of an item with at least one of the items was .30 < *r* <.90. From the table presented below, all the items in this construct correlated sufficiently.

Table 4.11: Inter-item Correlation for Items in Attitude towards Career Choice

	ACC1	ACC2	ACC3	ACC4	ACC5	ACC6
ACC1	1.00					
ACC2	.60	1.00				
ACC3	.51	.69	1.00			
ACC4	.52	.59	.57	1.00		
ACC5	.44	.46	.42	.53	1.00	
ACC6	.56	.53	.46	.53	.66	1.00

As mentioned previously, item retention in the scales was determined based on the significant factor loadings and the goodness of fit indices. The initial measurement model of attitude towards career choice offered a poor fit with χ^2/df > 5.00 and RMSEA > .08. Since the tested model was not valid, the the model was improved using modification indices. ACC 5 and ACC6 were removed due to low factor loading and the error variance between e2 and e4 was stabilised. The revised measurement model for attitude towards career choice generated a better fit with GFI, TLI and CFI above .90, RMSEA below .08, and χ^2/df below 3.00. The factor loadings of the retained items were above .60, AVE > .50 (.61) and CR >.70 (.85), hence indicating good convergent validity of the construct of attitude towards career choice.

For subjective norms, it consisted of three domains namely teachers, parents and friends. Each domain was made up of five items. Hence, there were five items measuring subjective norm by teachers among the Form Four students. The overall mean for this domain was 3.65 with a standard deviation of 0.85. Table 4.12 shows that three out of the five items in this construct were above the overall mean. SNT3 “My teachers’ advice is important to my career choice in STEM” scored the highest mean (*M* = 3.83, *SD* = 1.11), followed by SNT4 (*M*

= 3.78, *SD* = 1.05) and SNT5 (*M* = 3.76, *SD* = 1.02). SNT1 "My teachers think that I should choose a career in STEM" (*M* = 3.61, *SD* = 0.98) scored below the overall mean, whereas SNT2 "My teachers think that I should choose a career in STEM, therefore I should" scored the lowest mean (*M* = 3.28, *SD* = 1.11).

Table 4.12: Descriptive Statistics for Subjective Norm (Teachers)

	Item	*M*	*SD*
SNT1	My teachers think that I should choose a career in STEM.	3.61	0.98
SNT2	My teachers think that I should choose a career in STEM, therefore I should.	3.28	1.11
SNT3	My teachers' advice is important to my career choice in STEM.	3.83	1.11
SNT4	My teachers' teaching will encourage me to choose a career in STEM.	3.78	1.05
SNT5	My teachers' teaching will increase my interest to choose a career in STEM.	3.76	1.02

Table 4.13 presents the inter-item correlation matrix for subjective norm (teachers). The maximum correlation of an item with at least one of the items was .30 < *r* <.90. Hence, all items in this construct were proven have correlated adequately.

Table 4.13: Inter-item Correlation for Items in Subjective Norm (Teachers)

	SNT1	SNT2	SNT3	SNT4	SNT5
SNT1	1.00				
SNT2	.63	1.00			
SNT3	.48	.56	1.00		
SNT4	.51	.52	.64	1.00	
SNT5	.50	.55	.57	.68	1.00

All items in the initial measurement model for the construct subjective norm (teachers) indicated factor loadings above .60. However, the initial model indicated a poor model fit as the value of RMSEA exceeded .08. Hence, the error variance between e2 and e4 was stabilised using modification indices, and SNT1 was eliminated due to low loading during model improvement. A good model fit was also established for the teacher construct as the revised model passed all the criterion values (GFI, TLI and CFI > .90, RMSEA < .08, χ^2/df < 3.00). The AVE measure was .61 and CR was .86, thus meeting the recommended values for convergent validity (AVE > .50, CR > .70).

Similarly, there were five items in the construct measuring subjective norm (parents) among the Form Four students. The overall mean for this construct was 3.69 with a standard deviation of 0.88. Table 4.14 shows that three out of the five items in this construct exceeded the overall mean. SNP3 “My parents’ advice is important to my career choice in STEM” scored the highest mean (*M* = 3.92, *SD* = 1.04), followed by SNP1 (*M* = 3.71, *SD* = 1.02) and SNP4 (*M* = 3.70, *SD* = 1.11). SNP5 (*M* = 3.68) and SNP2 (*M* = 3.45) scored below the overall mean with standard deviation values of 1.06 and 1.09, respectively.

Table 4.14: Descriptive Statistics for Subjective Norm (Parents)

	Item	*M*	*SD*
SNP1	My parents think that I should choose a career in STEM.	3.71	1.02
SNP2	My parents think that I should choose a career in STEM, therefore I should.	3.45	1.09
SNP3	My parents’ advice is important to my career choice in STEM.	3.92	1.04
SNP4	My parents encourage me to choose a career in STEM.	3.70	1.11
SNP5	My parents’ encouragement will increase my interest to choose a career in STEM.	3.68	1.06

The inter-item correlation matrix is presented in Table 4.15. The maximum correlation of an item with at least one of the items was .30 < *r* <.90. In Table 4.15, it is shown that all the items in this construct correlated sufficiently.

Table 4.15: Inter-item Correlation for Items in Subjective Norm (Parents)

	SNP1	SNP2	SNP3	SNP4	SNP5
SNP1	1.00				
SNP2	.64	1.00			
SNP3	.54	.56	1.00		
SNP4	.73	.59	.53	1.00	
SNP5	.58	.59	.64	.61	1.00

The initial model of subjective norm (parents) indicated a poor model fit with χ^2/df > 5.00 and RMSEA > .08. Consequently, the process of enhancing the model was performed using modification indices. The error variances were stabilised (e2 and e4) and SNP3 was dropped due to low loading during model improvement. A good model fit was established for the construct of subjective norm (parents) as the revised model passed all the criterion values (GFI, TLI and CFI > .90, RMSEA < .08, χ^2/df < 3.00). In addition, the AVE measure was .65 and CR was .88, thus meeting the recommended values for convergent validity (AVE > .50, CR > .70).

The construct of subjective norm (friends) also comprised five items. The overall mean for this construct was 3.36 with a standard deviation of 0.93. In Table 4.16, SNF3 "My friends' advice is important to my career choice in STEM" had the same mean score as the overall mean with a standard deviation of 1.14. Only one item scored below the overall mean, that is SNF2 "My friends think that I should choose a career in STEM, therefore I should" with the mean value of 3.19 and a standard deviation of 1.12. On the other hand, SNF5 (M = 3.48, SD = 1.10), SNF1 (M = 3.41, SD = 1.05) and SNF4 (M = 3.39, SD = 1.10) scored above the overall mean with the value of 3.36.

Table 4.16: Descriptive Statistics for Subjective Norm (Friends)

	Item	*M*	*SD*
SNF1	My friends think that I should choose a career in STEM.	3.41	1.05
SNF2	My friends think that I should choose a career in STEM, therefore I should.	3.19	1.12
SNF3	My friends' advice is important to my career choice in STEM	3.36	1.14
SNF4	My friends encourage me to choose a career in STEM.	3.39	1.10
SNF5	My friends' encouragement will increase my interest to choose a career in STEM.	3.48	1.10

The inter-item correlation matrix is presented in Table 4.17. The maximum correlation of an item with at least one of the items was $.30 < r < .90$. As shown in Table 4.17, all the items in this construct correlated sufficiently.

Table 4.17: Inter-item Correlation for Items in Subjective Norm (Friends)

	SNF1	SNF2	SNF3	SNF4	SNF5
SNF1	1.00				
SNF2	.66	1.00			
SNF3	.61	.68	1.00		
SNF4	.68	.68	.60	1.00	
SNF5	.61	.67	.70	.62	1.00

The initial model showed a weak model fit with χ^2/df above 5.00 and RMSEA larger than .08. In the process of improving the model, the error variances were stabilised (e1 and e4, e3 and e5). A good model fit was established for the subjective norm (friends) construct with the criterion values GFI, TLI and CFI > .90, RMSEA < .08, and χ^2/df < 3.00. Besides, this construct also provided evidence of convergent validity as the factor loadings for all items in this construct were above .60, with AVE > .50 (.63) and CR > .70 (.90), suggesting adequate convergent validity.

There were three dimensions in the subjective norms construct, namely teachers, parents and friends. Each domain under subjective norms had been assessed independently, hence CFA was carried out to decide the model fit of the overall subjective norms model at this stage. According to Hair et al. (2010), covariances between the measured indicators in the first-order measurement models are explained with individual latent construct, whereas multiple first-order models constitute to a second-order model. As presented in Table 4.18, the correlation among the three domains were .30 < r <.90.

Table 4.18: Descriptive Statistics and Inter-item Correlation for Subjective Norms

	Number of items	*M*	*SD*	Teachers	Parents	Friends
Teachers	4	3.65	0.85	1.00		
Parents	4	3.69	0.88	.75	1.00	
Friends	5	3.36	0.93	.75	.75	1.00

The GOF indices obtained from the initial measurement model of subjective norms indicated poor fit as GFI and TLI < .90, RMSEA > .08, and χ^2/df > 5.00. The overall GOF indices were established for the revised model of subjective norms after SNT2, SNP2, SNF3 and SNF 4 were dropped due to low loadings during model improvement. It reflected a good fit of the model in the given sample a good fit of GFI, CFI and TLI with > .90, RMSEA < .08, and χ^2/df < 5.00 (Hair et al., 2010). The factor loadings for all the three dimensions were all above .60: Teachers (.89), parents (.94) and friends (.89), with AVE of .89 and

CR of .93 (AVE > .50, CR > .70), hence suggesting good convergent validity. Based on these indicators, the construct of subjective norms with the three dimensions was considered apt for the subsequent model testing.

The next construct consisted of eight items measuring media exposure. Table 4.19 shows the descriptive statistics for media exposure among Form Four students. The overall mean for the media exposure construct was 3.62 with a standard deviation of 0.72. Five out of the eight items exceeded the overall mean in this construct. ME4 scored the highest mean (*M* = 4.03, *SD* = 1.00), whereas ME8 (*M* = 2.89, *SD* = 1.21) scored the lowest mean. Besides, ME1 and ME7 scored the same mean of 3.85, with standard deviation values of 1.09 and 1.14, respectively.

Table 4.19: Descriptive Statistics for Media Exposure

	Item	*M*	*SD*
ME1	I spend time watching television/online television channels (e.g., Movie, television programme, drama, etc.).	3.85	1.09
ME2	I spend time reading newspaper/online newspaper/e-newspaper(s).	3.08	1.14
ME3	I spend time reading book/online book/ e-book(s).	3.43	1.10
ME4	I spend time surfing the internet.	4.03	1.00
ME5	I spend time scrolling through social media on the internet (e.g., Facebook, Twitter, Instagram, etc.).	3.91	1.13
ME6	I spend time on social networking services (e.g., WhatsApp, WeChat, LINE, etc.).	3.90	1.04
ME7	I spend time on YouTube.	3.85	1.14
ME8	I spend time on online/offline promotional materials (e.g., Poster, billboard, advertisement, flyer, etc.).	2.89	1.21

The inter-item correlation matrix media exposure is presented in Table 4.20. The requirement for correlation between items should be between .30 and .90. Based on Table 4.20, three out of the eight items (ME2, ME3 and ME8) had correlation values below .30, suggesting that they were not within the measured construct. Hence, five items (ME1, ME4, ME5, ME6 and ME7) in the construct which correlated adequately were retained.

Table 4.20: Inter-item Correlation for Items in Media Exposure

	ME1	ME2	ME3	ME4	ME5	ME6	ME7	ME8
ME1	1.00							
ME2	.30	1.00						
ME3	.30	.45	1.00					
ME4	.48	.21	.33	1.00				
ME5	.46	.21	.18	.56	1.00			
ME6	.45	.20	.19	.45	.63	1.00		
ME7	.44	.24	.23	.52	.51	.46	1.00	
ME8	.21	.38	.28	.12	.23	.33	.23	1.00

The factor loadings for all retained items in media exposure were above .50. The initial measurement model of media exposure had a poor model fit (GFI, TLI and CFI < .90, RMSEA > .08, χ^2/df > 5.00). Therefore, the model was improved using modification indices. Hence, error variance between e5 and e6 was stabilised. Consequently, the measurement model of ME had five remaining items (ME1, ME4, ME5, ME6 and ME7) with factor loadings > .60. The revised measurement model of media exposure also met the requirement of convergent validity with desirable AVE (.50) and CR (.82) with a good model fit with the data (GFI, TLI and CFI > .90, RMSEA < .08, χ^2/df < 3.00).

Furthermore, there were eight items in the construct measuring students' perception on financial reward. The overall mean for the financial reward construct was 3.94 with a standard deviation of 0.76. Table 4.21 shows that FR1 "A career in STEM pays well" scored the highest mean (*M* = 4.11, *SD* = 0.90). Other items that scored above the overall mean were FR5 (*M* = 4.05, *SD* = 0.91), FR6 (M = 4.01, SD = 0.90), FR2 (M = 4.00, SD = 0.92) and FR4 (M = 3.95, SD = 0.91). On the other hand, items scored below the overall mean were FR7 (M = 3.90, SD = 0.93), FR3 (M = 3.88, SD = 0.91) and FR8 (M = 3.64, SD = 1.07).

Table 4.21: Descriptive Statistics for Financial Reward

	Item	M	SD
FR1	A career in STEM pays well.	4.11	0.90
FR2	A career in STEM will give me good long-term earnings.	4.00	0.92
FR3	A career in STEM will give me good starting salary.	3.88	0.91
FR4	A career in STEM will give me stable income.	3.95	0.91
FR5	A career in STEM will provide me good living standard.	4.05	0.91
FR6	A career in STEM will give me a financially secured future.	4.01	0.90
FR7	A career in STEM allows me to make a lot of money.	3.90	0.93
FR8	A career in STEM pays better than other careers.	3.64	1.07

Table 4.22 presents the inter-item correlation matrix for financial reward. The maximum correlation of an item with at least one of the items was $.30 < r < .90$. Table 4.22 shows that all items in the construct correlated adequately within the range of $.30 < r < .90$.

Table 4.22: Inter-item Correlation for Items in Financial Reward

	FR1	FR2	FR3	FR4	FR5	FR6	FR7	FR8
FR1	1.00							
FR2	.71	1.00						
FR3	.64	.68	1.00					
FR4	.59	.65	.68	1.00				
FR5	.60	.63	.62	.73	1.00			
FR6	.61	.68	.63	.73	.71	1.00		
FR7	.62	.65	.59	.63	.70	.72	1.00	
FR8	.44	.45	.53	.50	.46	.47	.54	1.00

The initial measurement model of financial reward offered a poor fit with χ^2/df and RMSEA exceeded 5.00 and .08, respectively. The factor loadings for all items in the financial reward construct were above .60 except FR8, hence it was removed during model improvement. Using modification indices, error variances were stabilised (e1 and e2, e1 and e3, e2 and e3, e4 and e7). Therefore, the revised model met the requirement of convergent validity with desirable AVE (.65) and CR (.93) with a good model fit with the data (GFI, TLI and CFI > .90, RMSEA < .08, $\chi2$/df < 3.00).

For career interest, there were eight items in the construct. The overall mean for the career interest construct was 4.08 with a standard deviation of 0.67. Table 4.23 shows that three out of the eight items in this construct were above the overall mean. CI2 "I will choose a career that I like" scored the highest mean (*M* = 3.41, *SD* = 0.84), followed by CI1 "I will choose a career that I find interesting" (*M* = 4.31, *SD* = 0.92), and CI3 "I will choose a career that allows me to learn new things each day" (*M* = 4.19, *SD* = 0.90). Item that scored the lowest mean in this construct was CI4 (*M* = 3.85, *SD* = 0.98).

Table 4.23: Descriptive Statistics for Career Interest

	Item	*M*	*SD*
CI1	I will choose a career that I find interesting.	4.31	0.92
CI2	I will choose a career that I like.	4.41	0.84
CI3	I will choose a career that allows me to learn new things each day.	4.19	0.90
CI4	I will choose a career that is challenging for me.	3.85	0.98
CI5	I will choose a career that is related to the subjects that I like in school.	4.05	1.00
CI6	I will choose a career that is related to the subjects I do well in exams	3.93	1.03
CI7	I will choose a career that is related to the activities I like in school.	3.90	1.02
CI8	It will be an interesting experience for me to meet new people at my workplace.	4.00	0.98

Table 4.24 presents the inter-item correlation matrix for career interest. The maximum correlation of an item with at least one of the items was .30 < *r* < .90. Based on Table 4.24, all items in the career interest construct correlated adequately except CI4. Thus, CI4 was removed because its correlation value with other items was below .30, indicating that this item was not within the measured construct.

Table 4.24: Inter-item Correlation for Items in Career Interest

	CI1	CI2	CI3	CI4	CI5	CI6	CI7	CI8
CI1	1.00							
CI2	.73	1.00						
CI3	.53	.53	1.00					
CI4	.32	.32	.51	1.00				
CI5	.39	.41	.44	.26	1.00			
CI6	.34	.32	.32	.24	.59	1.00		
CI7	.35	.31	.41	.31	.65	.58	1.00	
CI8	.43	.44	.44	.39	.32	.39	.40	1.00

The initial model for career interest offered a poor fit with GFI, TLI and CFI < .90, RMSEA > .08, χ^2/df > 5.00. The process of modification indices was done to improve the model of CI, error variance was stabilised (e3 and e6), and four items (CI1, CI2, CI4 and CI8) were removed due to low loadings. Subsequently, the measurement model of career interest reached a good fit with the data with GFI, TLI and CFI >.90, RMSEA < .08 and χ^2/df < 3.00. The revised model of CI also met the requirement of convergent validity with AVE > .50 (.53) and CR > .70 (.81).

Finally, there were four items in the construct measuring students' intention to choose a career in STEM. The overall mean for this construct was 3.61 with a standard deviation of 0.98. Table 4.25 reports the career choice intention among Form Four students. CCI1 (*M* = 3.61, *SD* = 1.01), CCI3 (*M* = 3.61, *SD* = 1.06) and CCI4 (*M* = 3.61, *SD* = 1.07) had the same mean score as the overall mean. On the other hand, CCI2 "I intend to choose a career in STEM" scored the lowest mean of 3.59 with a standard deviation of 1.07.

Table 4.25: Descriptive Statistics for Career Choice Intention

	Item	*M*	*SD*
CCI1	I will choose a career in STEM.	3.61	1.01
CCI2	I intend to choose a career in STEM.	3.59	1.07
CCI3	I aim to choose a career in STEM.	3.61	1.06
CCI4	I plan to choose a career in STEM.	3.61	1.07

The inter-item correlation matrix for career choice intention is presented in Table 4.26. Since the maximum correlation of an item with at least one of the items was between .30 and .90, all items in the career choice intention construct correlated sufficiently.

Table 4.26: Inter-item Correlation for Items in Career Choice Intention

	CCI1	CCI2	CCI3	CCI4
CCI1	1.00			
CCI2	.83	1.00		
CCI3	.79	.78	1.00	
CCI4	.82	.84	.85	1.00

The factor loadings for all items the initial model for career choice intention were above .60, but the model offered a poor fit as χ^2/df was over 5.00 and RMSEA was over .08. Using modification indices, error variance between e3 and e6 was stabilised, hence all four items in the CCI construct were retained. The revised model offered a good fit with the data with GFI, CFI and TLI > .90, RMSEA < .08, and χ^2/df < 3.00. Besides, the measurement model for career choice intention also met the requirement of convergent validity with AVE > .50 (.81) and CR > .70 (.94).

In the final stage to evaluate the measurement model of the study, the seven latent constructs (perceived behavioural control, attitude towards career choice, subjective norms, media exposure, financial reward, career interest, and career choice intention) had been tested individually before they were compiled into one complete measurement model (Appendix E4). In the assessment of the overall measurement model of this study, the convergent validity, discriminant validity and model fit were tested.

The initial model shows that the model was marginally fit with GFI > .80 (GFI = .881). Besides, CI3 loaded below .60, and the initial measurement model did not meet the requirement of the discriminant validity test because the square root of the AVE (diagonal) for ACC was less than one of the correlations with another factor (off-diagonal) (Hair et al., 2010). Thus, the model was further inspected. Model improvement was done using modification indices, thus ACC1, ME1, ME7 and CI3 were eliminated due to low factor loading (< .60) at this stage.

As a result, the overall measurement model achieved a good fit with the data. Table 4.27 presents the GOF indices for the final measurement model of the study. From the results, it was reported that the complete measurement model of this study which consisted of seven latent constructs achieved a good model fit with GFI, TLI and CFI > .90, RMSEA < .08, and χ^2/df < 3.00.

Table 4.27: Goodness-of-fit Indices for the Final Measurement Model of the Study

Fit Indices	Recommended cut-offs[a]	Results	Fit (Yes/No)
Goodness-of-fit (GFI)	> .90	.903	Yes
Tucker-Lewis index (TLI)	> .90	.945	Yes
Comparative fit index (CFI)	> .90	.951	Yes
Root mean square error of approximation (RMSEA)	≤ .08	.050	Yes
Normed chi-square (χ^2/df)	1.00-5.00	2.973	Yes

[a] The desired range of values for a good fit based on Hair et al. (2010).

In addition, the convergent validity of the final measurement model of the study was also tested. According to Table 4.28, the final measurement model indicated good convergent validity as all factors loaded above .60, AVE exceeded .50 and CR exceeded .70.

Table 4.28: Convergent Validity for the Final Measurement Model of the Study

Construct		F.L.	CR	AVE
Perceived Behavioural Control (PBC)		**0.77-0.88**	**0.92**	**0.70**
PBC1	I am confident I will be able to choose a career in STEM.	0.63		
PBC2	I think it is easy for me to choose a career in STEM.	0.77		
PBC3	I expect myself to have the ability to choose a career in STEM.	0.86		
PBC4	I have good ability to choose a career in STEM.	0.88		
PBC5	I have the self-confidence to choose a career in STEM.	0.86		
Attitude towards Career Choice (ACC)		**0.78-0.85**	**0.85**	**0.65**
ACC2	A career in STEM will make me feel good.	0.85		
ACC3	A career in STEM will make me happy.	0.78		
ACC4	A career in STEM is meaningful to me.	0.79		

Table 4.28: Convergent Validity for the Final Measurement Model of the Study (continued)

Subjective Norms (SN)		**0.89-0.94**	**0.94**	**0.83**
Teachers		*0.73-0.83*		
SNT3	My teachers' advice is important to my career choice in STEM.	0.73		
SNT4	My teachers' teaching will encourage me to choose a career in STEM.	0.83		
SNT5	My teachers' teaching will increase my interest to choose a career in STEM.	0.82		
Parents		*0.72-0.83*		
SNP1	My parents think that I should choose a career in STEM.	0.72		
SNP4	My parents encourage me to choose a career in STEM.	0.73		
SNP5	My parents' encouragement will increase my interest to choose a career in STEM.	0.83		
Friends		*0.79-0.82*		
SNF1	My friends think that I should choose a career in STEM.	0.79		
SNF2	My friends think that I should choose a career in STEM, therefore I should.	0.82		
SNF5	My friends' encouragement will increase my interest to choose a career in STEM.	0.81		
Media Exposure (ME)		**0.68-0.78**	**0.77**	**0.53**
ME4	I spend time surfing the internet.	0.78		
ME5	I spend time scrolling through social media on the internet (e.g., Facebook, Twitter, Instagram, etc.).	0.72		
ME6	I spend time on social networking services (e.g., WhatsApp, WeChat, LINE, etc.).	0.68		
Financial Reward (FR)		**0.72-0.86**	**0.93**	**0.65**
FR1	A career in STEM pays well.	0.72		
FR2	A career in STEM will give me good long-term earnings.	0.78		
FR3	A career in STEM will give me good starting salary.	0.75		
FR4	A career in STEM will give me stable income.	0.86		
FR5	A career in STEM will provide me good living standard.	0.84		
FR6	A career in STEM will give me a financially secured future.	0.85		
FR7	A career in STEM allows me to make a lot of money.	0.84		

Table 4.28: Convergent Validity for the Final Measurement Model of the Study (continued)

Career Interest (CI)		**0.74-0.82**	**0.82**	**0.61**
CI5	I will choose a career that is related to the subjects that I like in school.	0.82		
CI6	I will choose a career that is related to the subjects I do well in exams.	0.74		
CI7	I will choose a career that is related to the activities I like in school.	0.78		
Career Choice Intention (CCI)		**0.89-0.93**	**0.95**	**0.82**
CCI1	I will choose a career in STEM.	0.89		
CCI2	I intend to choose a career in STEM.	0.91		
CCI3	I aim to choose a career in STEM.	0.90		
CCI4	I plan to choose a career in STEM.	0.93		

Note. F.L. = Factor Loading, CR = Composite Reliability. AVE = Average Variance Extracted.

The results of correlation matrix, average squared shared variance (ASV), maximum shared variance (MSV) and AVE were generated using the statistical script created by Gaskin (2012) to evaluate discriminant validity of the model. From the results shown in Table 4.29, the square root of AVE (diagonal entries) is greater than the correlations between constructs (off-diagonal entries). Based on the results, the constructs measured in this measurement model were different from one another, thus providing satisfactory evidence for the absence of discriminant issues.

Table 4.29: Discriminant Validity for the Final Measurement Model

Construct	AVE	MSV	ASV	ACC	FR	CI	ME	CCI	PBC	SN
ACC	0.65	0.63	0.42	**0.81**						
FR	0.65	0.47	0.29	0.57	**0.81**					
CI	0.61	0.30	0.24	0.52	0.45	**0.78**				
ME	0.53	0.27	0.18	0.37	0.43	0.52	**0.73**			
CCI	0.82	0.67	0.42	0.76	0.52	0.52	0.42	**0.91**		
PBC	0.70	0.61	0.38	0.75	0.53	0.40	0.34	0.73	**0.84**	
SN	0.83	0.67	0.47	0.79	0.68	0.55	0.41	0.82	0.78	**0.91**

Note. ACC: Attitude towards Career Choice; FR: Financial Reward; CI: Career Interest; ME: Media Exposure; CCI: Career Choice Intention; PBC: Perceived Behavioural Control; SN: Subjective Norms; AVE: Average Variance Extracted; MSV: Maximum Shared Variance; ASV: Average Squared Shared Variance.

Besides, Hair et al. (2010) suggested that the measured values for ASV and MSV should be lesser than the values of AVE. As shown in Table 4.29, the discriminant validity of the model was established that both values of MSV and ASV are lower than AVE for the constructs. Collectively, the statistical evidence reported above suggested that the convergent validity and discriminant validity for the variables were successfully established in the current study. Therefore, the measurement model of this study was considered apt for the subsequent analyses.

Stage 5: Specifying the Structural Model. The measurement model of the study had been assessed and was proven fit at Stage 4. Hence, the model can be specified at Stage 5 to establish the structural model which the hypotheses proposed in line with Objective 1 can be tested. At this stage, the structural model was arranged and specified based on the following hypotheses:

H1: Perceived behavioural control has a significant influence on career interest.

H2: Perceived behavioural control has a significant influence on career choice intention.

H3: Attitude towards career choice has a significant influence on career interest.

H4: Attitude towards career choice has a significant influence on career choice intention.

H5: Subjective norms have a significant influence on career interest.

H6: Subjective norms have a significant influence on career choice intention.

H7: Subjective norms have a significant influence on attitude towards career choice.

H8: Media exposure has a significant influence on career interest.

H9: Media exposure has a significant influence on career choice intention.

H10: Media exposure has a significant influence on attitude towards career choice.

H11: Financial reward has a significant influence on career interest.

H12: Financial reward has a significant influence on career choice intention.

H13: Career interest has a significant influence on career choice intention.

Stage 6: Assessing Structural Model Validity. In Stage 6, SEM was used to examine the overall model fit and the causal strengths of individual causal paths in the model utilising model-fit indices (Hair et al., 2010). Hence, a set of model-fit indices (GFI, TLI and CFI > .90, RMSEA < .08, χ^2/df < 5.00) was used to assess the structural model of the study. The fit indices and their level of acceptable fit for the proposed structural model are displayed in Table 4.30. From the results, the proposed model demonstrated a good fit with CFI = 0.95, TLI = 0.94, GFI = 0.90, RMSEA = 0.05, and χ^2/df = 3.04 (χ^2 = 1502.301, *df* =

494).

Table 4.30: Fit Indices for the Structural Model

Fit Indices	Recommended cut-offs[a]	Results	Fit (Yes/No)
Goodness of Fit (GFI)	> .90	.901	Yes
Tucker-Lewis index (TLI)	> .90	.943	Yes
Comparative fit index (CFI)	> .90	.950	Yes
Root mean square error of approximation (RMSEA)	≤ .08	.051	Yes
Normed chi-square (χ^2/df)	1.00-5.00	3.041	Yes

[a]The desired range of values for a good fit based on Hair et al. (2010).

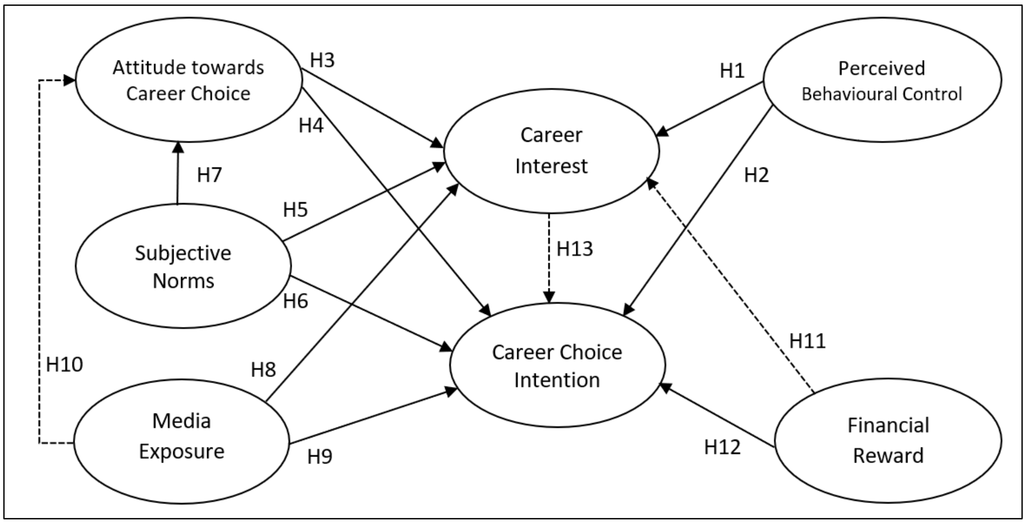
A summary of the hypothesis testing results is shown in Table 4.31. From the results, the standardised path coefficients for H4 (β = .199), H6 (β = .587), H7 (β = .816), H8 (β = .335) and H12 (β = -.122) were significant at $p < .001$. H1 (β = -.191), H3 (β = .221) and H5 (β = .372) were statistically significant at $p < 0.01$, whereas the standardised path coefficients for H2 (β = .123) and H9 (β = .083) were significant at $p < 0.05$. On the other hand, H10, H11 and H13 were not supported in this study ($p > 0.05$).

Table 4.31: Hypothesis Testing Summary for the First Objective

	Paths	Standard Estimate	Critical Ratio	*p*	Results
H1	PBC → CI	-.191	-2.703	.007**	Supported
H2	PBC →CCI	.123	2.472	.013*	Supported
H3	ACC → CI	.221	2.751	.006**	Supported
H4	ACC → CCI	.199	3.592	***	Supported
H5	SN → CI	.372	2.954	.003**	Supported
H6	SN → CCI	.587	6.356	***	Supported
H7	SN → ACC	.816	16.721	***	Supported
H8	ME → CI	.335	6.028	***	Supported
H9	ME → CCI	.083	2.436	.015*	Supported
H10	ME → ACC	.033	.958	.338	Not Supported
H11	FR → CI	.019	.350	.726	Not Supported
H12	FR → CCI	-.122	-3.310	***	Supported
H13	CI → CCI	.055	1.522	.128	Not Supported

Note. **p* < .05; ***p* < .01; *** *p* < .001.

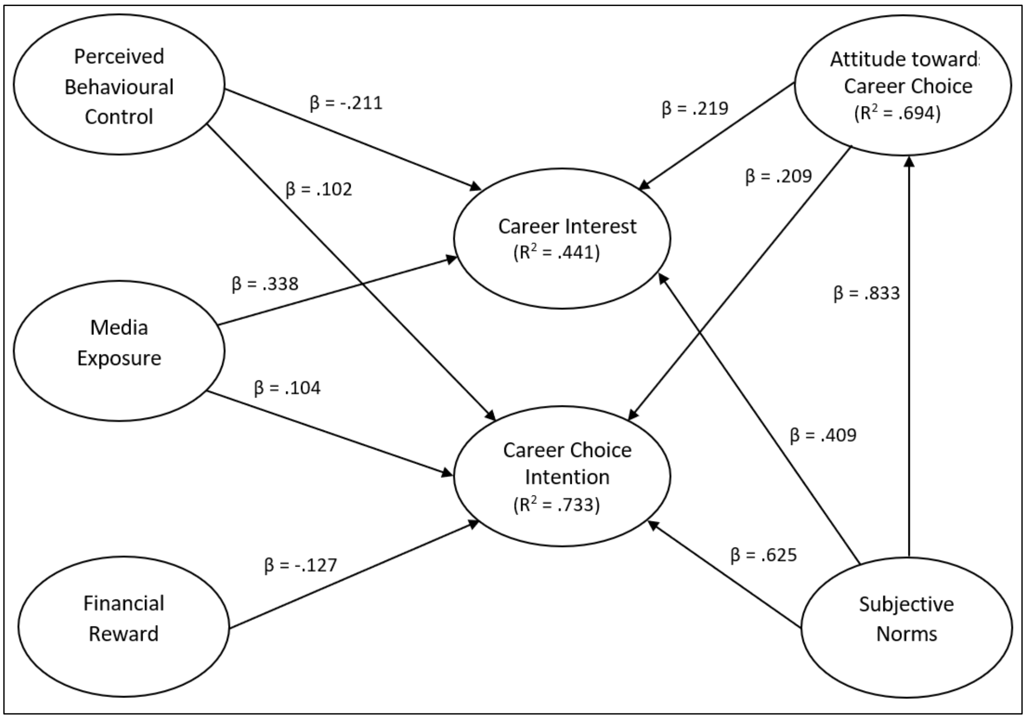
The structural model derived from the conceptual framework which entails significant and non-significant paths is displayed in Figure 4.2. The tests of the structural model confirmed that ten out of 13 proposed hypotheses were supported by the results of this study. Among the confirmed hypotheses, two of them showed negative causal relationships. These findings will be discussed in the subsequent chapter.



Note. Dotted arrows: Non-significant paths.

Figure 4.2: The Structural Model Derived from the Conceptual Framework

Hair et al. (2010) noted that parsimony fit measure yields a simpler model as fewer parameters paths are estimated in the model, and it is useful in comparing the fit of two models. This can be done by omitting the non-significant paths from the model as depicted in Figure 4.3 (van Braak, 2004). The parsimonious revised structural model also generated a lower Akaike Information Criterion (AIC) value (1701.417) than the revised structural model (1704.301), suggesting the parsimonious revised structural model offers better fitting and parsimony than the previous structural model. Therefore, the parsimonious revised structural model in Figure 4.3 is regarded as the final research model of this study.



Note. β = Path coefficient, R^2 = Squared multiple correlations (variance explained)

Figure 4.3: The Final Model of the Study (Parsimonious Revised Structural Model)

Table 4.32. shows the standardised regression weights for the parsimonious revised structural model of this study. Based on the results, the coefficient values for all the paths were significant at $p < .05$ with critical ratio above ±1.96.

Table 4.32: Standardised Regression Weights for the Parsimonious Structural Model

Paths	Standard Estimate	Critical Ratio	P value
PBC → CI	-.211	-3.092	.002**
PBC →CCI	.102	2.087	.037*
ACC → CI	.219	2.740	.006**
ACC → CCI	.209	3.713	***
SN → CI	.409	3.672	***
SN → CCI	.625	6.736	***
SN → ACC	.833	17.835	***
ME → CI	.338	6.205	***
ME → CCI	.104	3.298	***
FR → CCI	-.127	-3.451	***

Note. $^{*}p < .05$; $^{**}p < .01$; *** $p < .001$.

Attitude towards career choice, career interest and career choice intention were the endogenous variables in this study. Table 4.33. shows the values of the coefficient of determination R^2 for these endogenous variables. From this hypothesised model, it can be estimated that 69.4% of the variance in attitude towards career choice was explained by subjective norms ($\beta = .833$, $p < .001$). Besides, the explained variance of career interest was 44.1%. The most significant contributor towards career interest was subjective norms ($\beta = .409$, $p < .001$), followed by media exposure ($\beta = .338$, $p < .001$), attitude towards career choice ($\beta = .219$, $p < .01$) and perceived behavioural control ($\beta = -.211$, $p < .01$). Additionally, subjective norms did not only directly influence career interest, but also via attitude towards career choice.

Table 4.33: Explained Variances (Squared Multiple Correlations) for the Final Model of the Study

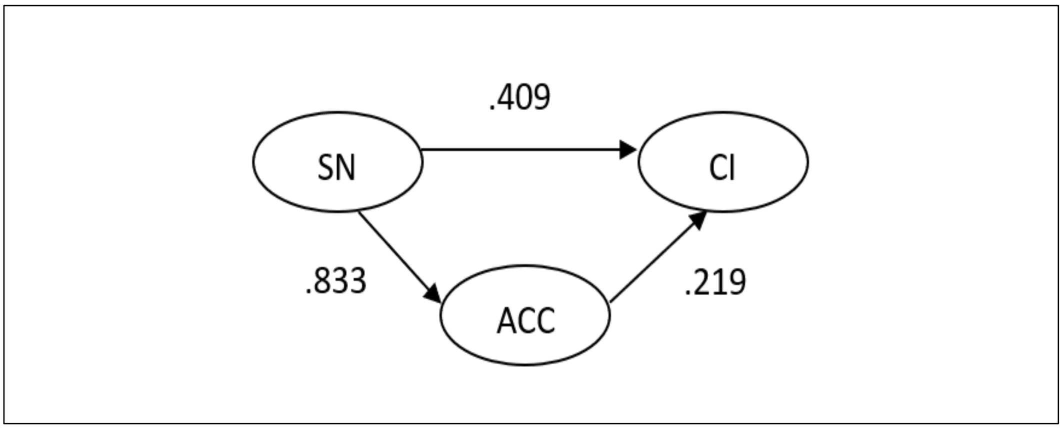
Endogenous Variable	Estimate	Explained Variance
Attitude towards Career Choice	.694	69.4%
Career Interest	.441	44.1%
Career Choice Intention	.733	73.3%

Overall, 73.3% of CCI among students in Peninsular Malaysia was explained in the final research model of this study (Table 4.33). The percentage of this variance is accounted for by the collective influence of subjective norms, attitude towards career choice, perceived behavioural control, financial reward and media exposure. Based on Table 4.32, subjective norms ($\beta = .625$, $p < .001$) was the most influential contributor in explaining the variance in career choice. Moreover, attitude towards career choice ($\beta = .209$, $p < .001$) was the second most significant contributor towards career choice intention, followed by perceived behavioural control ($\beta = .102$, $p < .05$), financial reward ($\beta = -.127$, $p < .001$) and media exposure ($\beta = .104$, $p < .001$).

4.4.2 Mediation

According to Objective 2, this study aimed to examine the role of mediators for secondary school students' intention to choose a career in STEM. Thus, the mediating effect via the two proposed mediators in this study were attitude towards career choice and career interest.

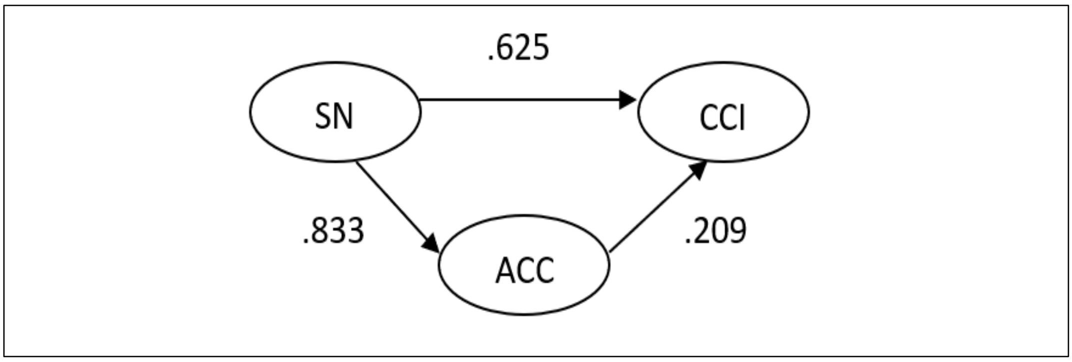
As illustrated in Figure 4.4, attitude towards career choice was hypothesised as the mediating influence of subjective norms and career interest. The direct effect of subjective norms on career interest was .409. Meanwhile, the size of indirect effect was calculated by multiplying the estimated path coefficients from subjective norms to attitude towards career choice (.833) and the estimated path coefficient from attitude towards career choice to career interest (.219). According to Hair et al. (2010), indirect effects which are above .08 are considered sizeable, whereas indirect effects below .08 will not be interpreted. Hence, the indirect influence of subjective norms on career interest via attitude towards career choice was statistically significant at .182 with $p = .006$ ($p < .01$). Therefore, H14 was supported because attitude towards career choice was a partial mediator between subjective norms and career interest.



Note. SN: Subjective norms; ACC: Attitude towards career choice (mediator); CI: Career interest.

Figure 4.4: Direct and Indirect Paths of Subjective Norms on Career Interest

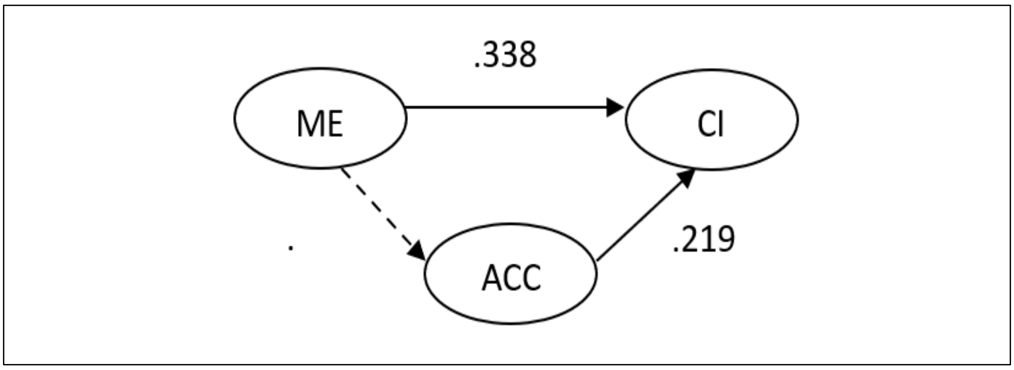
Figure 4.5 shows that attitude towards career choice was hypothesised as the mediator influence of subjective norms and career choice intention. The direct effect of subjective norms on career choice intention was .625. The indirect influence of subjective norms on career choice intention through attitude towards career choice was above .08 at .174 (.833 x .209) with statistically significance of $p = .001$ ($p < .001$). Thus, H15 was confirmed that attitude towards career choice was a partial mediator which mediated the influence between subjective norms and career choice intention.



Note. SN: Subjective norms; ACC: Attitude towards career choice (mediator); CCI: Career choice intention.

Figure 4.5: Direct and Indirect Paths of Subjective Norms on Career Choice Intention

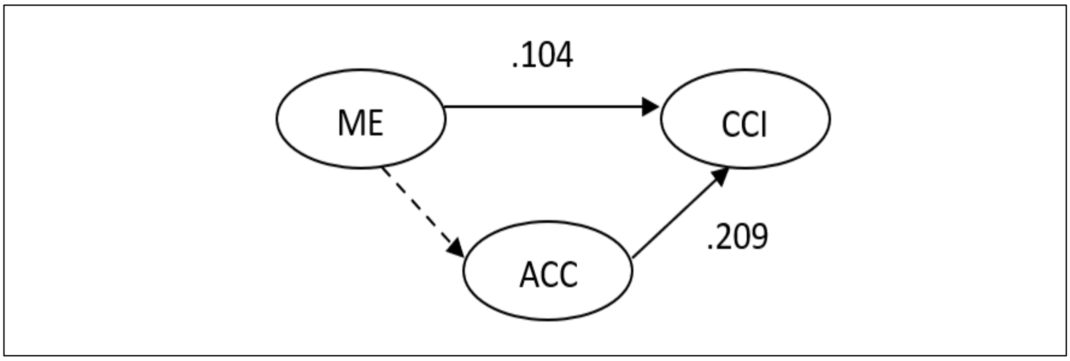
In Figure 4.6, media exposure was hypothesised to influence career interest indirectly via attitude towards career choice. However, the indirect effect via attitude towards career choice cannot be determined due to the non-significant path between media exposure and attitude towards career choice. Hence, H16 was not supported.



Note. ME: Media exposure; ACC: Attitude towards career choice (mediator); CI: Career interest.

Figure 4.6: Direct and Indirect Paths of Media Exposure on Career Interest

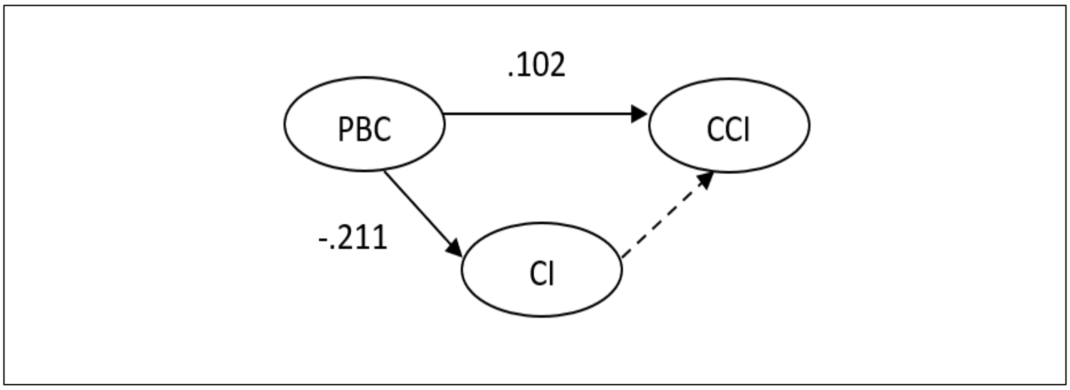
Figure 4.7. depicts the hypothesised indirect effect of media exposure on career choice intention via attitude towards career choice. Similarly, there was no significant direct effect from media exposure to attitude towards career choice. The indirect effect could not be calculated because of the non-significant path from media exposure to attitude towards career choice. Therefore, H17 was not supported.



Note. ME: Media exposure; ACC: Attitude towards career choice (mediator); CCI: Career Choice Intention.

Figure 4.7: Direct and Indirect Paths of Media Exposure on Career Choice Intention

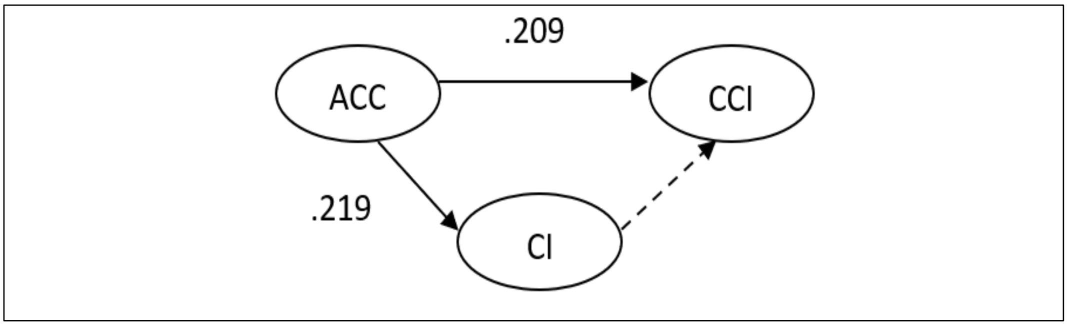
As shown in Figure 4.8, perceived behavioural control was hypothesised to influence career choice intention indirectly through career interest. Nonetheless, the indirect effect from perceived behavioural control to career choice intention via career interest could not be determined due to the non-significant path between career interest and career choice intention. Hence, H18 was not supported, suggesting career interest did not mediate the influence of perceived behavioural control on career choice intention.



Note. PBC: Perceived behavioural control; CI: Career interest (mediator); CCI: Career choice intention.

Figure 4.8: Direct and Indirect Paths of Perceived Behavioural Control on Career Choice Intention

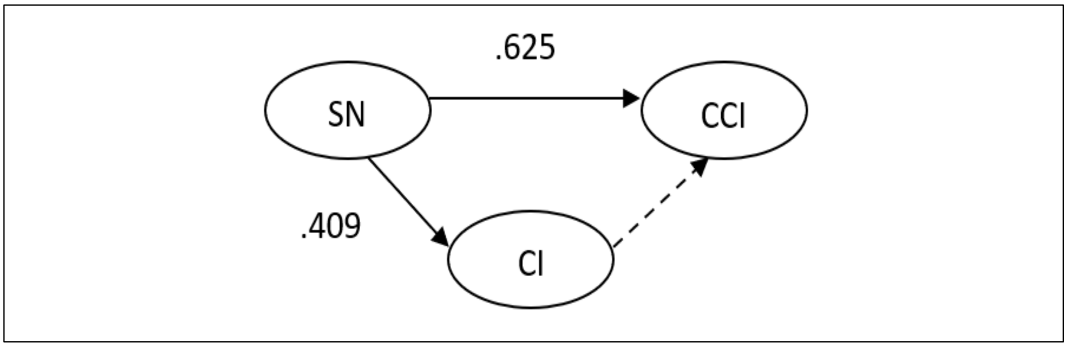
The illustration in Figure 4.9 shows the hypothesised indirect effect of attitude towards career choice on career choice intention via career interest. Since there was no significant direct effect from career interest to career choice intention, the indirect effect between attitude towards career choice and career choice intention via career interest could not be calculated. Thus, career interest was not a mediator between attitude towards career choice and career choice intention, and H19 was not supported.



Note. ACC: Attitude towards career choice; CI: Career interest (mediator); CCI: Career choice intention.

Figure 4.9: Direct and Indirect Paths of Attitude towards Career Choice on Career Choice Intention

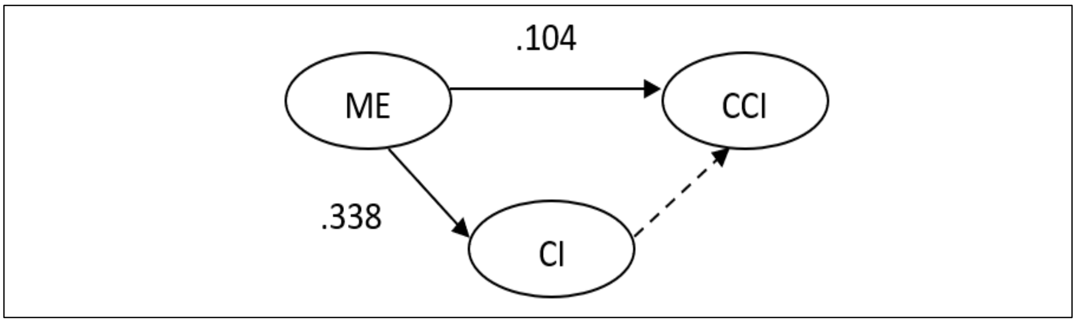
It was proposed that career interest was a mediator between subjective norms and career choice intention. However, Figure 4.10 shows that the indirect effect from subjective norms to career choice intention via career interest could not be determined because the path between career interest and career choice intention was not significant. Hence, H20 was not supported.



Note. SN: Subjective norms; CI: Career interest (mediator); CCI: Career choice intention.

Figure 4.10: Direct and Indirect Paths of Subjective Norms on Career Choice Intention

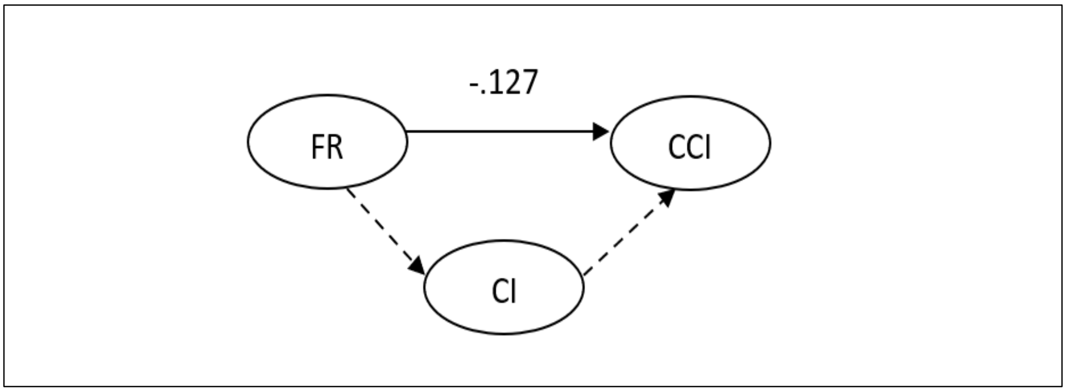
Career interest was also hypothesised to have a mediating effect between media exposure and career choice intention. In Figure 4.11, the indirect effect between media exposure and career choice intention could not be calculated because of the non-significant path between career interest and career choice intention. Therefore, career interest was not a mediator between media exposure and career choice intention, and H21 was not supported.



Note. ME: Media exposure; CI: Career interest (mediator); CCI: Career choice intention.

Figure 4.11: Direct and Indirect Paths of Media Exposure on Career Choice Intention

Figure 4.12 shows the direct and indirect paths of financial reward on career choice intention. In H22, financial reward was hypothesised to influence career choice intention indirectly via career interest. However, the indirect effect between financial reward and career choice intention through career interest could not be calculated due to non-significant paths from financial reward to career interest, and from career interest to career choice intention. Hence, H22 was not supported in this study.



Note. FR: Financial reward; CI: Career interest (mediator); CCI: Career choice intention.

Figure 4.12: Direct and Indirect Paths of Financial Reward on Career Choice Intention

Table 4.34 shows the hypothesis testing summary according to the second objective of the study. In summary, it can be concluded that attitude towards career choice was the only significant mediator in this study, whereas career interest was not a statistically significant mediator. Based on the results, attitude towards career choice was a statistically significant mediator which had indirect effects from subjective norms to career interest and career choice intention, respectively.

Table 4.34: Hypothesis Testing Summary for the Second Objective

Hypothesis	Path	Indirect Effect Value	Result
H14	SN→ACC→CI	.182**	Supported (Partial Mediation)
H15	SN→ACC→CCI	.174***	Supported (Partial Mediation)
H16	ME→ACC→CI	n.s.	Not supported
H17	ME→ACC→CCI	n.s.	Not supported
H18	PBC→CI→CCI	n.s.	Not supported
H19	ACC→CI→CCI	n.s.	Not supported
H20	SN→CI→CCI	n.s.	Not supported
H21	ME→CI→CCI	n.s.	Not supported
H22	FR→CI→CCI	n.s.	Not supported

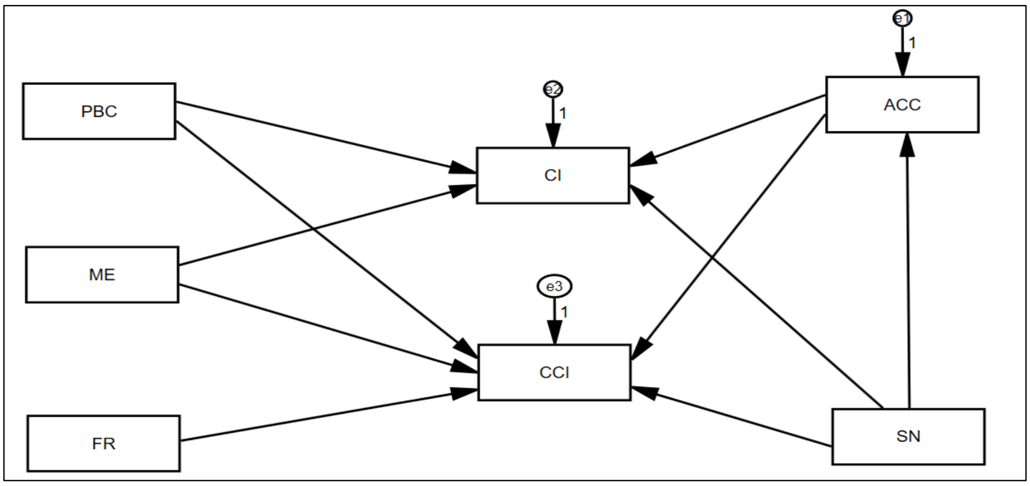
Note. **$p < .01$; *** $p < .001$; n.s.: Non-significant.

4.4.3 Moderation

In line with Objective 3, this study aimed to test whether streams of study act as a moderator for STEM career choice between STEM and non-STEM students. H23 was hypothesised based on this objective to examine if the structural paths proposed in the structural model would generate similar results for the STEM and non-STEM stream students. Hence, the multigroup analysis was conducted on the final research model developed from this study (Figure 4.3).

Two groups of samples involved in this analysis were STEM students (n = 345) and non-STEM students (n = 441). In multigroup analysis, an unconstrained model and a constrained model were formed separately. It was hypothesised that the unconstrained model would yield different regression weights for STEM and non-STEM students. On the other hand, the constrained model was hypothesised to share similar regression weights despite the streams of study (i.e., STEM and non-STEM). Subsequently, the two models would be compared in the multigroup analysis.

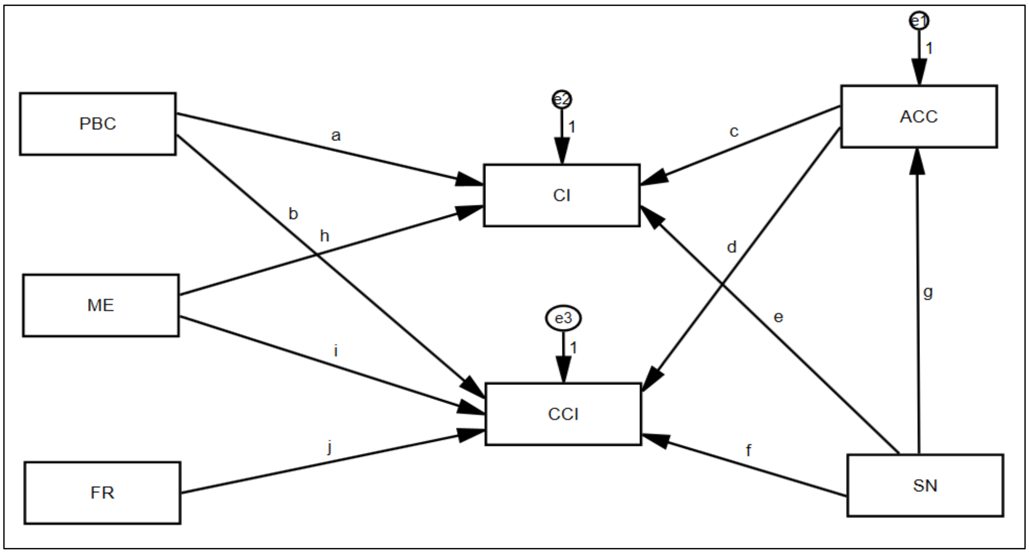
Figure 4.13 shows the unconstrained structural model for STEM and non-STEM students (n = 786) from this study. In this model, the path coefficients in the model were freely estimated as the analysis was conducted without imposing any constraints on the causal paths. This model generated a significant χ^2 of 153.509 (n = 786, df = 10) with statistical significance of $p < .05$.



Note. ACC: Attitude towards Career Choice; FR: Financial Reward; CI: Career Interest; ME: Media Exposure; CCI: Career Choice Intention; PBC: Perceived Behavioural Control; SN: Subjective Norms.

Figure 4.13: Unconstrained Structural Model for STEM and Non-STEM Students

On the other hand, the constrained structural model was illustrated in Figure 4.14. In this model, all paths were constrained to equality for the respective sample (STEM and non-STEM). The paths were labelled 'a' to 'j' to represent the regression weight of each respective path. Therefore, each path in STEM sample was constrained to have an equivalent coefficient as the corresponding path in the non-STEM sample. As a result, the constrained model yielded a significant χ^2 of 172.714 (n = 786, df = 20) with $p < .05$.



Note. ACC: Attitude towards Career Choice; FR: Financial Reward; CI: Career Interest; ME: Media Exposure; CCI: Career Choice Intention; PBC: Perceived Behavioural Control; SN: Subjective Norms.

Figure 4.14: Constrained Structural Model for STEM and Non-STEM Students

From the results as shown in Table 4.35, the χ^2 and df values of the unconstrained and constrained models were different. The difference in χ^2 between the two models was 19.205 (172.714 - 153.509) with $p = 0.038$ ($p < .05$), suggesting moderation was supported as the two models differ significantly. Therefore, the proposed hypothesis H23 was confirmed by the results whereby streams of study moderate career choice among STEM and non-STEM students.

Table 4.35: Chi-square Goodness-of-fit and Degree of Freedom for the Unconstrained and Constrained Models

Model	Chi-square (X^2)	*df*
Unconstrained	153.509	10
Constrained	172.714	20

Besides, the significant difference in the X^2 values between the unconstrained and constrained models suggested differences in the effect of structural paths for STEM and non-STEM students. Critical ratio test was thus conducted to investigate the differences in regression weights according to the streams of study. In view of this, the regression weights should be obtained from the unconstrained model instead of the constrained model because the differences in the structural paths could only be detected when they were estimated freely. Hence, the fit of model parameters set for the respective stream of study was compared based on the regression weights generated from the unconstrained model.

The results for STEM and non-STEM students are portrayed in Table 4.36 and Table 4.37, respectively. In the comparison of the structural paths between the two streams of study, it was found that most of the paths were statistically significant at $p < .05$ with critical ratios above ±1.96. Based on Table 4.36 and Table 4.37, it was found that the paths from perceived behavioural control to career interest was only significant for STEM students (> ±1.96, $\beta = .118$, $p < .05$), whereas the path was insignificant for non-STEM students as critical ratio was below ±1.96 with $p > .05$. Besides, the structural path of financial reward to career choice intention was significant for non-STEM students (> ±1.96, β = .-119, $p < .05$), but insignificant for STEM students. In sum, it can be concluded that the structural paths between the constructs were varied for STEM and non-STEM students regarding their choice of career.

Table 4.36: Standardised Regression Weights and Critical Ratios for STEM Students

Path	Standard Estimate	Critical Ratio	*p*	Result
SN→ ACC	.661	16.337	***	Supported
PBC → CCI	.192	3.978	***	Supported
ME → CI	.236	5.202	***	Supported
ME → CCI	.138	2.064	.015*	Supported
ACC → CI	.246	4.244	***	Supported
ACC → CCI	.310	6.626	***	Supported
SN → CI	.249	3.538	***	Supported
SN → CCI	.353	5.945	***	Supported
PBC → CI	.127	1.969	.049*	Supported
FR → CCI	.018	.388	.148	Not Supported

Note. **p* < .05, *** *p* < .001.

Table 4.37: Standardised Regression Weights and Critical Ratios for Non-STEM Students

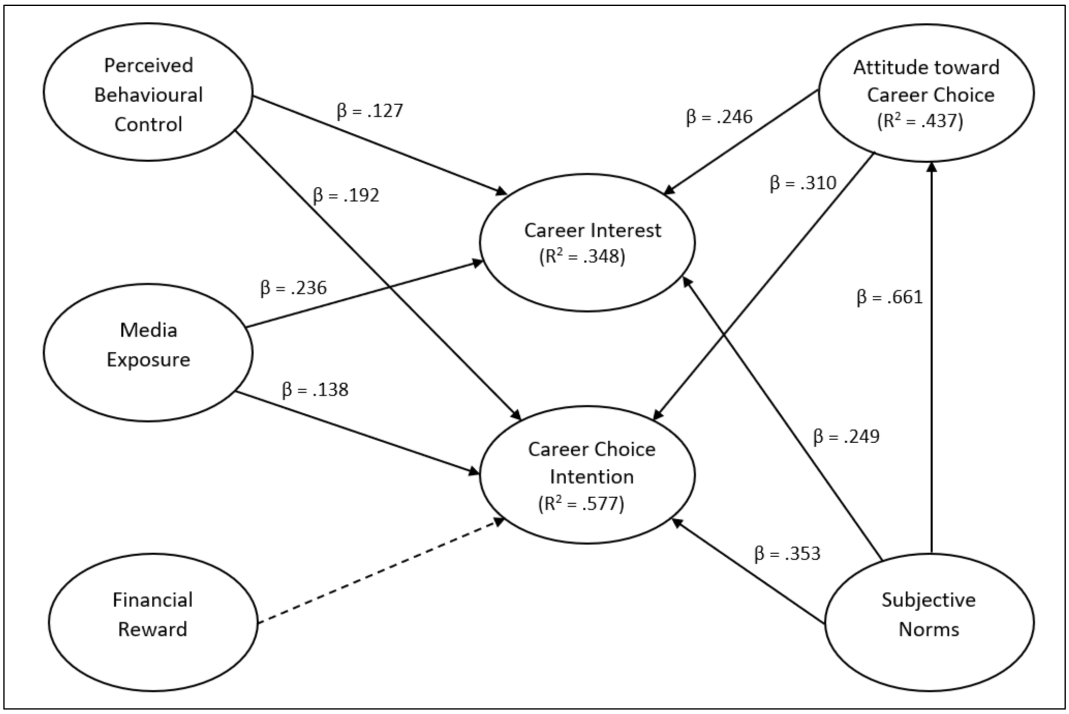
Path	Standard Estimate	Critical Ratio	*p*	Result
SN→ ACC	.686	19.798	***	Supported
PBC → CCI	.226	5.420	***	Supported
ME → CI	.316	7.471	***	Supported
ME → CCI	.114	3.631	***	Supported
ACC → CI	.225	4.115	***	Supported
ACC → CCI	.247	6.264	***	Supported
SN → CI	.241	3.444	***	Supported
SN → CCI	.407	7.428	***	Supported
PBC → CI	-.106	-1.664	.096	Not Supported
FR → CCI	-.119	-1.962	.048*	Supported

Note. **p* < .05, *** *p* < .001.

As displayed in Table 4.38 and Figure 4.15, 43.7% of the variance in attitude towards career choice was explained by subjective norms (β = .661) among students from STEM stream. Moreover, 34.8% of variance in career interest among STEM students was jointly explained by subjective norms (β = .249), attitude towards career choice (β = .246), media exposure (β = .236) and perceived behavioural control (β = .192). For career choice intention, over half of its variance was jointly explained by subjective norms (β = .353), attitude towards career choice (β = .310), perceived behavioural control (β = .192) and media exposure (β = .138).

Table 4.38: Explained Variances (Squared Multiple Correlation) by Streams of Study

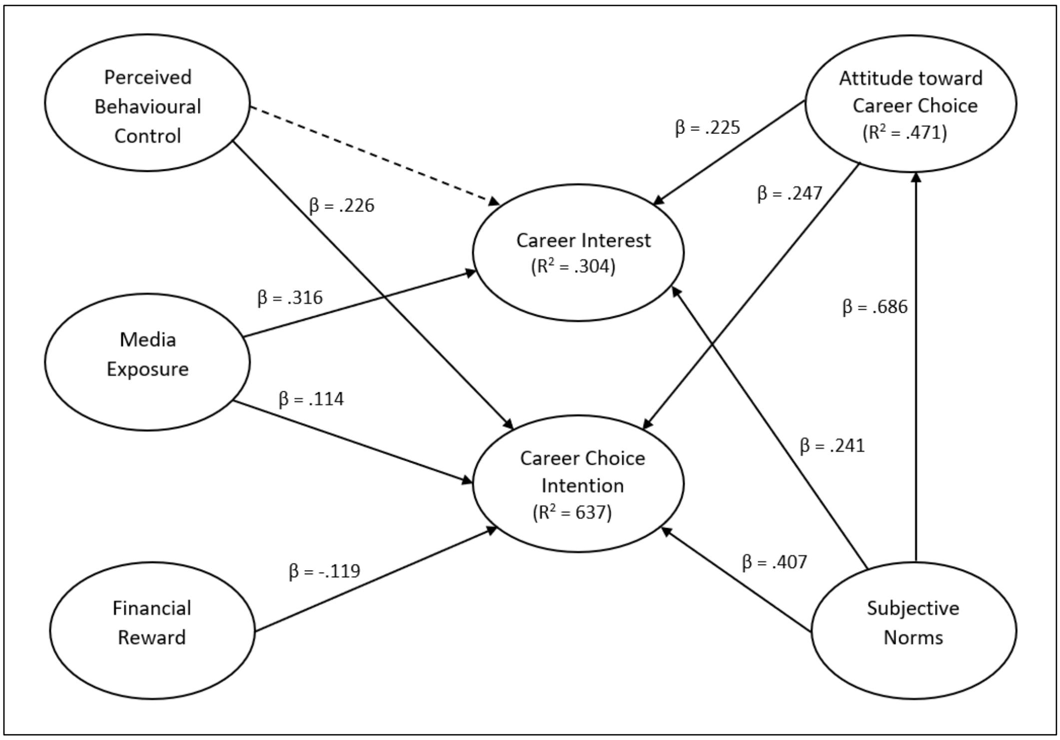
Endogenous Variable	STEM		Non-STEM	
	Estimate	Explained Variance	Estimate	Explained Variance
Attitude towards Career Choice	.437	43.7%	.471	47.1%
Career Interest	.348	34.8%	.304	30.4%
Career Choice Intention	.577	57.7%	.637	63.7%



Note. β = Path coefficient, R^2 = Squared multiple correlations (variance explained); Dotted arrow: Non-significant path.

Figure 4.15: The Final Research Model for STEM Students

For students from the non-STEM stream, 47.1% of the variance in attitude towards career choice was explained solely by subjective norms (β = .686). Table 4.38 and Figure 4.16 shows that the explained variance in career interest (30.4%) was accounted for media exposure (β = .316), attitude towards career choice (β = .225) and subjective norms (β = .241). Meanwhile, the joint influence of subjective norms (β = .407), attitude towards career choice (β = .247), perceived behavioural control (β = .226), financial reward (β = -.119), and media exposure (β = .114) contributed to the variance explained in career choice intention (63.7%) among the non-STEM students.



Note. β = Path coefficient, R^2 = Squared multiple correlations (variance explained); Dotted arrow: Non-significant path.

Figure 4.16: The Final Research Model for Non-STEM Students

4.5 Concluding Remarks

Chapter 4 has presented the analyses of data collected in this study. Preliminary analyses were done to ensure the data were apt for the inferential analyses. The respondents' demographic information was also reported in this chapter to describe their profiles and backgrounds that are relevant to this study. To test the hypotheses aligned with the research objectives, the six stages of SEM were employed to establish verified measurement and structural models. Mediation and moderation assessments were also done using SEM to answer Objective 2 and 3. As a result, 13 out of 23 of the hypotheses were supported by the data of this study. Chapter 5 will discuss the findings obtained from this chapter.

CHAPTER 5

DISCUSSION AND CONCLUSION

5.1 Introduction

This is the final chapter of the thesis. Chapter 5 begins with a summary that outlines the overall study, followed by a comprehensive discussion according to the research objectives and findings in the preceding chapter. This chapter also entails the theoretical and practical implications of the study. Lastly, the limitations of the study and recommendations for future research are presented at the end of this chapter.

5.2 Summary of the Study

The aim of this study was to determine the factors that influence STEM and non-STEM students' career choice intention. Specifically, this study was conducted to develop a model based on the TPB and analyse the influence of the proposed predictors in the model. The hypothesised predictors were perceived behavioural control, attitude towards career choice, subjective norms, media exposure, financial reward, and career interest. In line with the purpose of this research, the role of the mediators (attitude towards career choice and career interest) and moderator (streams of study) were also assessed concerning students' career choice in STEM.

The research instrument of the study was a bilingual online questionnaire with 55 five-point-likert scale items measuring the proposed constructs. The questionnaire was subjected to content validation and translation by experts in the respective fields. The questionnaire was also pre-tested and pilot tested prior to data collection. Through proportional stratified cluster sampling, a total of 806 responses was obtained from Form Four students in Peninsular Malaysia. The collected data were analysed using IBM SPSS to generate results for preliminary tests, consequently 786 sets of data were retained for multivariate analyses. SEM was carried out using AMOS for hypothesis testing and model validation to answer the research questions. The final model of this study consisted of 34 items as shown in Table 4.28. The results of this study were summarised in correspondence to the research hypotheses as below:

RQ1: Are there significant influences of the proposed antecedents (perceived behavioural control, attitude towards career choice, subjective norms, financial reward, media exposure and career interest) on secondary school students' intention to choose a career in STEM?

	Hypotheses	Results
H1	Perceived behavioural control has a significant influence on career interest.	Supported
H2	Perceived behavioural control has a significant influence on career choice intention.	Supported
H3	Attitude towards career choice has a significant influence on career interest.	Supported
H4	Attitude towards career choice has a significant influence on career choice intention.	Supported
H5	Subjective norms have a significant influence on career interest.	Supported

H6	Subjective norms have a significant influence on career choice intention.	Supported
H7	Subjective norms have a significant influence on attitude towards career choice.	Supported
H8	Media exposure has a significant influence on career interest.	Supported
H9	Media exposure has a significant influence on career choice intention.	Supported
H10	Media exposure has a significant influence on attitude towards career choice.	Not supported
H11	Financial reward has a significant influence on career interest.	Not supported
H12	Financial reward has a significant influence on career choice intention.	Supported
H13	Career interest has a significant influence on career choice intention.	Not supported

RQ2: Do attitude towards career choice and career interest significantly mediate the proposed model for secondary school students' intention to choose a career in STEM?

	Hypotheses	Results
H14	Attitude towards career choice mediates the influence of subjective norms on career interest.	Supported
H15	Attitude towards career choice mediates the influence of subjective norms on career choice intention.	Supported
H16	Attitude towards career choice mediates the influence of media exposure and career interest.	Not Supported
H17	Attitude towards career choice mediates the influence of media exposure and career choice intention.	Not Supported
H18	Career interest mediates the influence of perceived behavioural control on career choice intention.	Not Supported
H19	Career interest mediates the influence of attitude towards career choice on career choice intention.	Not Supported

H20	Career interest mediates the influence of subjective norms on career choice intention.	Not Supported
H21	Career interest mediates the influence of media exposure on career choice intention.	Not Supported
H22	Career interest mediates the influence of financial reward on career choice intention.	Not Supported

RQ3: Do secondary school students' streams of study (STEM and non-STEM) act as a moderator for their intention to choose a career in STEM?

	Hypothesis	Result
H23	The streams of study (STEM and non-STEM) moderate students' career choice intention in STEM.	Supported

According to the reported results, 13 out of 23 hypotheses were supported by the data of the present study. The final model produced from this study explained 73.3% of variance in students' career choice intention in STEM. The antecedents (perceived behavioural control, attitude towards career choice, and subjective norms) in the original TPB remained significant predictability towards career choice intention in the STEM context. Alongside the three antecedents, the newly proposed variable media exposure was also found to have significant influence on students' career interest and choice intention, but not on attitude towards career choice. On the other hand, financial reward was a statistically significant predictor of students' career choice intention in general, but it was not predictive of students' career interest. The findings of this research also revealed that career interest was not a significant antecedent that predicted students' career choice intention in STEM. Moreover, attitude towards career choice was the only significant mediator in this research, whereas career interest was not. Based on the results from multigroup analysis, this study also found that streams of study moderated students' career choice between STEM and non-STEM students. The inferences drawn from the results will be discussed in the subsequent sections to answer the research questions corresponding to the research objectives.

5.3 Discussion on Findings

5.3.1 The Influence of Antecedents on the Model Measuring Career Choice Intention in STEM

This study successfully developed a model to predict students' career choice in STEM based on the TPB. According to the model, 73.3% variance in students' career choice intention was explained by subjective norms, followed by attitude towards career choice, financial reward, media exposure, and perceived behavioural control. Meanwhile, subjective norms, media exposure, perceived behavioural control, and attitude towards career choice jointly explained 44.1 % of variance in students' career interest.

Subjective norms had the strongest statistical influence on students' career choice intention and career interest in this study. This implies that teachers, parents and friends play vital roles in students' career choices in STEM. Echoed with many previous studies (Bergin, 2016; Kong et al., 2020; Krupat et al., 2017; Mohtar et al., 2019), teachers, parents and friends (subjective norms) were indeed significant referents who were influential over students' involvement and pursuit in STEM. Based on the findings of the present study, teachers' advice and teaching can increase students' interest and encourage them to choose a career in STEM. This is consistent with Akosah-Twumasi et al. (2018) that students perceived teachers as their role models who facilitated them academically. Meanwhile, parental influence had a significant influence on students' STEM career interest and choice intention as students believed their parents' opinions and encouragements are valuable. This is because parents offer students STEM experience and home environment outside the classrooms by guiding them to explore activities that prepare them for future careers in STEM (Mohtar et al., 2019; Razali, 2021). Besides, the current study also found that students highly value their friends' opinions and encouragements for career interest and choice intention in STEM. This finding confirmed Bergin's (2016) research which reported peer influence on students' STEM career choice was attributable to peer norms. This means that students are more likely to develop motivation that is similar to their friends in terms of career choice (Bergin, 2016; Raabe et al., 2019). Therefore, students' perceived social pressure from their teachers, parents and friends is influential on their STEM career interest and choice intention.

Besides, attitude towards career choice was a significant antecedent that influenced students' career interest and choice intention in the model of this study. This means that students' favourable or unfavourable evaluations towards career choice had significant influence on their career interest and intention in STEM. Aligned with Yerdelen et al. (2016), this study also found that students' career interest was determined by attitude. This is because when students believe the career will make them feel good, happy and meaningful, their interest will also increase. Moreover, the influence of attitude on intention is in line with the TPB model which postulated attitude as a key component that led to intention (Ajzen, 1991). It concurs with Badri et al. (2016) and James et al. (2018) which reported on the influence of attitude on students' willingness to join the STEM professions. In particular, students intend to choose a STEM career when they believe the career will bring about happiness and positive feelings. While attitude is related to students' preference and judgement, students in this study showed greater likelihood to choose a career in STEM when they perceived the career was meaningful to them.

On the other hand, financial reward was not a significant predictor of students' career interest in this study. This finding contradicts Ahmad et al.'s (2015) research which suggested that accounting students would be more interested in the career when they perceived the job would offer a financially secured future. It was also noticed that respondents of the present study were 16-year-old secondary school students. On the other hand, respondents in Ahmad et al. (2015) were university students who aged above 21 years, and 52.1% of the 631 respondents had internship experience prior to the research. This could suggest that the influence of financial reward may differ based on age. Indeed, Matarese et al. (2019) stated that students' career choices are significantly related to their age. This was also acknowledged by Wang and Degol (2017) that the pathway to STEM careers is developmental that sociocultural factors such as age could interfere one's STEM career intention over time. Therefore, this finding could imply that secondary school students are unlike adult students as they do not focus on tangible career outcomes such as financial reward in career choice.

Nevertheless, the finding is consistent with Wen et al. (2018) that salary is not indicative of students' career preference. This means that students' patterns of likes, dislikes and indifferences related to STEM careers are not influenced by their perceived financial reward. Another interesting finding of this study is that financial reward had a negative significant influence on students' career choice intention in STEM. Though many previous research reported on the positive influence of financial benefits on career choice (Choo et al., 2012; Samsuri et al., 2016), the negative causal relationship found in this study is not surprising. Sithole et al. (2017) argued that the salary differential of STEM careers from other disciplines was deemed an advantage in STEM recruitment, but it is not the scenario nowadays. Lucrative income is regarded as an inhibiting factor against STEM careers because it is perceived as a high-paid job with underlying risks which can override financial benefits (Sithole et al., 2017). According to Jackling and Calero (2006), "risks" of these high-paid professions are such as requiring employees to obtain additional certifications after employment. Coinciding with Sithole et al. (2017), students are not likely to choose a career in STEM because decent salary, stable income and good living standard that STEM careers would offer are perceived as risks.

Another noteworthy finding of this study is that the newly added variable, media exposure was found to be an influential predictor of students' STEM career interest and choice intention. From the results, students indicated greater interest and intention in STEM careers when they spend more time on the internet, social media, and social networking services. As reported by Kricorian et al. (2020), students took the initiative to spend time on media where students follow social media accounts and websites, as well as watch movies or shows they considered relevant. Hence, it can be inferred that when students are exposed to media contents that are related to STEM careers, they would develop interest in the professions and are more likely to pursue the careers in STEM. However, it was suggested in the results that students' exposure to media did not shape their attitude towards career choice. This finding disagrees with Gehrau et al. (2016) who reported that students' judgement towards a profession was shaped by how it was portrayed in the media. It can be deduced that students are rather independent in terms of their attitude or evaluation on STEM careers, but not reliant on how STEM careers are portrayed in the media. Therefore, media should be used as a powerful tool to directly encourage students' interest and intention in choosing STEM careers. When contents related to STEM are spread via media, students who spend time on media will be exposed to the contents as well, hence developing interest and choice intention in STEM careers.

Likewise, perceived behavioural control was a significant predictor of career interest and career choice intention. The predictability of perceived behavioural control on intention confirmed the relationship between the two variables as hypothesised in Ajzen's (1991) TPB. This finding was also found in Ambad and Damit (2016) which asserted students were more motivated to choose an entrepreneurial career when they believed it was within their ability and easy for them to become an entrepreneur. In line with the previous studies, students in the current study indicated they had greater intention to opt for STEM careers when they had greater self-efficacy and controllability to choose a career in STEM. This means that when students perceived themselves to be confident, capable and have the control to decide their career, they are likely to choose a profession in STEM. Besides, the present study revealed that perceived behavioural control had a negative significant influence on students' career interest. Previous studies like Solikhah (2014) reported positive influence of perceived behavioural control on career interest among public accounting students which would result in career choice in STEM. Unlike Solikhah (2014), finding from the present study implies that when students have high confidence and ability to choose a career in STEM, they have more freedom in career choice despite their interests, academic achievements, and subjects or activities they like in school. This could be because when students recognise themselves to be confident and skilled, they have more opportunities and freedom to explore careers that attract them apart from STEM.

In this study, career interest was not a significant antecedent of students' career choice intention. The finding contradicts Nugent et al. (2015) which noted that students were more likely to pursue careers that they were interested in. According to Shahali, Halim, Rasul, Osman, and Zulkifeli (2017), career interest could potentially influence students' STEM career choice, but interest can only play a meaningful role when students have experience or real-life immersion related to STEM. It was explained that students' interest in STEM is meaningful when they gain experience by involving themselves in STEM programmes and activities (Shahali, Halim, Rasul, Osman, & Zulkifeli, 2017). This is because their actual participation and involvement in STEM learning activities and experiences will indicate their interest in STEM. This means when students have real-life experiences related to STEM, they will have better ideas whether they are interested in the profession. Hence, students' career choice intention is not solely indicated by their likes and dislikes without their actual experience in STEM.

As the influence of career interest on career choice intention was inconsistent with some previous studies, the literature review was revisited. It was noticed that some of the reviewed literature such as Humayon et al. (2018) and Murcia et al. (2020) were based on the social cognitive career theory in which the concept of career interest may not be translatable to the current study which was founded on the TPB. Besides, CI1, CI2, CI3, CI4, and CI8 were removed during model estimation due to low factor loadings and poor fit. It was found that the removed items were mostly adapted from past studies that measured students' career interest in accounting (Ahmad et al., 2015), and tourism and hospitality (Wan et al., 2014) contexts. In contrast, most of the retained items were developed by the researcher based on the definition and context of the current research. Hence, the significance of career interest could vary in the STEM context, and this further highlights the need for a career interest scale to measure students' career interest based on the unique context of STEM.

5.3.2 The Mediators

Based on the literature, the researcher performed a mediation test and the statistical results showed that attitude towards career choice was the only significant mediator in the model of this study. From the findings, partial mediations were found in the direct and indirect effects of attitude towards career choice between subjective norms and career interest, as well as between subjective norms and career choice intention. The mediating effects of attitude found in this study validated its intervening role as reported in prior research by Al-Swidi et al. (2014) and Mokhtar et al. (2016). This means subjective norms had indirect influences on career interest and career choice intention through attitude towards career choice. In other words, students' attitude can intervene the influence of teachers, parents and friends on their career interest and intention. These significant referents also shape students' evaluation and judgement towards career which in turn will affect their likelihood to choose a career in STEM. In specific, when students are encouraged by their significant referents to choose a STEM career, they will develop a positive impression and feeling towards the career, and will eventually be more interested and develop greater tendency to opt for the STEM career. Hence, this finding gives credence to the mediating role of attitude, with new evidence from the context of career choice in STEM grounded on the TPB.

However, attitude towards career choice was not a significant mediator between the relationship of media exposure and career interest, as well as media exposure and career choice intention due to the absence of direct effect from media exposure to attitude towards career choice. In the present study, the hypothesised relationships mentioned were not supported by the results and the prerequisites for a mediation test were not met. The finding is incongruence with Lim et al.'s (2017) study which suggested the effect of consumer attitude between social media influence and buying intention. Contradicting Lim et al.'s

(2017) study in the marketing context, it can be concluded that students' attitude does not play a significant role in translating the information receive from media contents to their interest and choice of professions. In other words, students may not think their exposure to media is relevant to shaping their attitude towards choosing a career in STEM because they are independent in their judgement on STEM professions. The contradicting finding suggests that media influence over consumer choice intention may not be directly translatable to students' career attitudes or choice intention. For example, findings from Lim et al. (2017) may not be interpreted similarly for career choice intention and attitude towards career choice among students because their samples were adults.

In this study, career interest was found to be a non-significant mediator in the model. Since career interest was not a significant antecedent of career choice intention, the proposed indirect effects with career interest as the mediator did not meet the prerequisites for a mediation test. Hence, the hypothesised mediating role of career interest that intervened the relationships from perceived behavioural control, attitude towards career choice, subjective norms, media exposure, and financial reward to career choice intention were not supported by the results of this study. This finding contradicts previous studies such as Mishkin et al. (2016) and Nugent et al. (2015) which reported on the significant mediating role of career interest. As discussed in the earlier section, students' career choice intention was not determined by their likes and dislikes of a career, thus the mediation role of career interest was not valid in this study. In sum, this finding suggests that students do not require career interest to develop intention to choose a profession in STEM in which perceived behavioural control, attitude towards career choice, subjective norms, and media exposure can influence their career choice intention in a linear manner without career interest. This suggested that students placed great importance on the media, significant others' opinions, as well as their personal control, confidence, and judgement in career choice without considering their emotional approach of indifferences towards the professions.

5.3.3 The Moderator

The third objective of this study was to test whether streams of study moderated students' career choice intention in STEM. As such, a multigroup analysis was carried out to test if the developed model varied between STEM and non-STEM students in this study. Findings provide new evidence to the existing literature that there was a significant difference between students from the two streams of study.

This finding is consistent with prior research that reported students' career choice varied by discipline, showing the difference between STEM and non-STEM students' career choice (Ertl & Hartmann, 2019; Sugahara & Boland, 2009). It was also suggested in Xu (2013) that the difference in specificity of STEM and non-STEM training could be an important reason that led to discernible career choice between the two groups of students. Likewise, Ahmad et al. (2015) explained that, as students progress in their studies, their attitudes and behaviours are moulded according to the discipline they are expected to pursue in future. This means STEM stream students who are expected to become

STEM professionals in future are provided with education that moulded them into the expected STEM roles, hence discerning them from non-STEM students who are expected to be STEM associates or non-STEM workers in future.

For STEM students, the path from financial reward to career choice intention was not significant. Contradictorily, financial reward was a significant predictor of career choice intention among non-STEM students. The distinct roles of financial reward found in this study is similar to Xu's (2013) which noted that non-STEM students were more affected by a set of comprehensive factors that included both monetary and non-monetary factors (Xu, 2013). This means STEM students are unlike non-STEM students in which STEM students do not require extrinsic financial benefits for their career choice intention because the existing STEM stream is sufficient to encourage them to choose STEM careers without considering monetary incentives.

Students' career interest was significantly influenced by subjective norms, attitude towards career choice and media exposure for both streams of study, while perceived behavioural control was only influential in predicting STEM students' career interest. As Ahmad et al. (2015) mentioned, each stream of study moulds students into their expected future roles. Career interest among non-STEM students is not reliant on their perceived behavioural control. This is because non-STEM stream students possibly perceived their ability and control over career choice are not specifically directed or limited to only STEM careers since they have greater opportunities to pursue non-STEM careers as compared to STEM students who are anticipated to be STEM professionals in future.

In fact, previous studies have compared STEM and non-STEM students' career choices, and there were similarities and differences in terms of the factors that affected their choice of career (Xu, 2013). Based on the findings, subjective norms were the strongest predictor while media exposure was the weakest predictor of career choice intention for both STEM and non-STEM students. Besides, students' career choice intention from both streams of study were also significantly influenced by attitude towards career choice and perceived behavioural control which further confirmed the original predictors in the TPB had strong predictive power towards intention.

5.4 Implications

As this study is an empirical study examining secondary school students' STEM career choice in Peninsular Malaysia through the lens of TPB, there are several useful implications that can be drawn from the research findings. Empirical evidence derived from the findings support the core objective of this research and added new insights to the existing mechanism of the TPB in explaining STEM career choice intention among teenage students. The following sections further articulates the implications of the study from the theoretical and practical perspectives.

5.4.1 Theoretical Implications

The findings of this study present significant contributions to the extant literature for several reasons. The current research is considered as the first career choice TPB-based study conducted after the implementation of the STEM-oriented streaming system in the Malaysian national curriculum. Previously, prior research has identified the feasibility of the TPB, and the potential features of media exposure, financial reward and career interest in conceptualising students' career choice. For this reason, TPB was used as the fundamental theory that guided the present research in determining factors that influence students' career choice intention in STEM specifically in Malaysia.

The results validated the hypothesised relationships within the proposed model. Hence, this study produced a comprehensive model in explaining the antecedents influencing career choice intention among STEM and non-STEM students. Based on the comprehensive model, two explicit models were also generated for STEM and non-STEM, respectively. This means that in addition to the comprehensive model which can be applied to assess students' career choice intention in general, the two specified models can also be used to examine career choice in STEM and non-STEM streams separately based on the requirement of research. The empirical findings of this study have also suggested a new approach to discuss STEM and non-STEM students' career choices in various facets that are of major concern in developing countries like Malaysia. Hence, his has expanded the current knowledge on students' career choices in STEM in Malaysia as students' career choice can also be examined according to their streams of study.

In particular, this study highlights the applicability of the TPB in STEM career choice context which the TPB constructs (subjective norms, attitude towards career choice and perceived behavioural control) remained powerful in predicting intention. Besides reproducing the relationships of the TPB constructs, this research also offers new insights into these variables which subjective norms were found to be the strongest predictor that influenced career choice intention directly for both STEM and non-STEM students. Another unique feature of this model is that subjective norms was identified as the only antecedent that influenced students' career choice intention indirectly via attitude. This also underscores the role of attitude as a versatile variable which functioned as an exogenous variable and a mediator in the model. With attitude as the only significant mediator, this study validated attitude as a profound variable which can directly influence students' career interest and intention, as well as connect subjective norms to intention. Therefore, these findings also add to the development and growing body of research on STEM career choice based on the TPB.

Incorporating media exposure, financial reward and career interest in this TPB-based model has also brought about new perspectives in discussions of students' STEM career choice. In addition to the above, this study revealed that the inclusion of media exposure, financial reward and career interest into the model did not only emphasise the importance of these concepts in STEM career choices, but also provided a better clarification on how these variables interact with the TPB variables in the model. For instance, students' media exposure was a significant predictor that influenced the career interest and career choice intention in STEM in which its predictive power was even stronger than perceived behavioural control in the original TPB. This finding suggests the imperative role of media in affecting students' career indifferences and planning, and that students nowadays highly depend on media contents for information acquisition. Therefore, the findings of this study have contributed to the modifications of the TPB based on the research context and objective, hence further confirmed its feasibility by incorporating new latent variables into the theory.

This study also revealed an interesting finding that financial reward had a significant negative influence on students' career choice intention for non-STEM students, but it was insignificant for STEM students. This finding also added new understanding to career choice research as financial reward has been widely believed to be a stimulating factor that leads to students' choice of career. Furthermore, previous studies have repeatedly underscored the significance of interest in career decisions, but the present study found otherwise.

This finding offers an intriguing perspective regarding the supposed importance of students' career interest because interest might not be a definite precursor that results in STEM and non-STEM students' career choice intention. This is a sharp contrast from some previous studies because students did not consider career interest as a critical factor in their STEM career choice. Thus, the finding disregards the assumed importance of career interest which could have been overemphasised in the existing knowledge in career choice. As such, new empirical evidence on media exposure, financial reward and career interest should be considered in future studies concerning students' career decisions, especially in the STEM context. Besides, inconsistent finding in career interest as compared to the literature has shed new light on theoretical implication. For instance, career interest scale that was developed based on other theory and fields of study are not translatable to the TPB in STEM. This means that the measurement of career interest should be developed align with the theoretical concept of the TPB based on the STEM context.

Another noteworthy theoretical contribution of this study is the measurement of the theoretical constructs included in the model as there was no specific instrument to measure STEM and non-STEM stream students' intention in the career choice context. As Ramayah et al. (2001) suggested, adopting foreign instrument may cause misleading results and findings in the Malaysian context especially when the instrument originates from the West. Hence, this study has updated and developed the scales based on a conceptualised model to measure secondary school students' career choice intention and its antecedents in the context of STEM. The research instrument was content validated, back-translated, pre-tested and pilot tested through a thorough process to establish reliability and validity needed for model assessments. As the results were inferred from a substantial sample involving students from 13 states in Peninsular Malaysia, the findings offer relevance and generalisability for future research.

5.4.2 Practical Implications

The findings have provided valuable insights that allow the practitioners, as well as all stakeholders especially the policy makers in seeking more practical, reflective and effective strategies to promote STEM career choice among students. There are several important practical implications that should be highlighted in this section to address the importance of the research findings.

The findings were retrieved from the results reported by the students under the latest national curriculum, KSSM. This STEM-oriented curriculum was introduced in 2017 and has been fully implemented nationwide since 2020. Hence, this study provides reflective and cutting-edge findings regarding students' career choices who are under the new national curriculum. The comprehensive model developed in this study reflects STEM and non-STEM students' career choice as a whole, and how the variables interact with one another in the model. As this study also identified the significant difference between STEM and non-STEM students' career choice, the two specific models can also be used when considering the needs of students from each stream of study. These models can be assimilated into the development and planning of STEM courses and initiatives by considering the factors influencing their STEM career choice.

For example, although many independent variables had direct influence on students' career interest and career choice intention directly, career interest did not influence career choice intention to choose STEM careers. Besides, career interest was also not a significant mediator, hence verifying that career interest has been overemphasised for career choices previously. This finding could explain the unsuccessful implementation of STEM-related strategies and activities because most of them were targeted to promote STEM careers by instilling students' career interest which interest was always assumed to motivate students' STEM participation (Shahali, Halim, Rasul, Osman, & Zulkifeli, 2017). This study suggests that even when students are interested in STEM careers, their likes, dislikes and indifferences towards STEM do not associate with their intention to choose STEM careers. Since the importance of career interest has been disregarded based on the research finding, more emphasis should be placed on promoting STEM via other significant factors instead of solely focusing on career interest.

In fact, subjective norms which entailed teachers, parents and friends had the strongest direct and indirect influence on students' career choice intention for both STEM and non-STEM stream students. This means that students' career choice intention also requires cooperation from their teachers, parents and friends. Many STEM-based activities have been initiated by the Malaysian MOE, government agencies, non-government organisations, universities, private sectors, and industrial players to encourage students' participation in STEM (Shahali, Ismail, & Halim, 2017). According to Shahali, Ismail, and Halim (2017), some of the programmes are such as STEM Mentor-mentee Programme which university educators are the mentors to teachers, whereas university students are the mentors to school students. Besides, the School-Parents Collaboration has also been initiated by the MOE to establish parents' partnership with schools to encourage children's awareness about the importance of STEM and STEM careers.

Based on the understanding of the finding, students should not be the sole focus in which teachers, parents and friends should also be included in these activities to effectively spur students' career choice intention in STEM. This is because when significant others are aware of the importance of STEM, and have experience in these activities, they can offer precise advice and encouragement to students, hence motivating them to pursue STEM. The roles of the significant others are crucial in students' career choice intention because they can also affect students' evaluation and judgement of a profession. This means that teachers, parents and friends should also be well-informed about STEM careers, and be included in the implementation of STEM initiatives in order to effectively prepare students for STEM careers. In other words, if the parents have positive remarks about STEM careers, students might also develop positive judgement about professions in STEM, subsequently they are more likely to choose careers in STEM. Therefore, it is suggested to include teachers, parents and friends through activities such as STEM exhibitions, workshops, hands-on practical sessions and mentor-mentee programmes.

Another useful implication that can be drawn from the finding is that media exposure can be used as a powerful tool to enhance students' career choice intention in STEM. As the media have taken over modern lives in this digital era, it is used extensively for information exchange and communication. Secondary school students in this study are digital natives who are media prone, and they grow up with high exposure to media which shapes their perceptions of the surrounding world (Sharma, 2015). Considering the imperative role of media exposure in students' career choice intention, more media contents that emphasise the importance and advantages of STEM careers can be advertised via the internet, social media, social networking services platforms. Specifically, advertisements or short audio-visual clips can be promoted on social media platforms like Facebook to disseminate information about STEM careers. The more students are exposed to STEM contents on media, the higher their tendency to choose a career in STEM.

Another important finding was the difference between STEM and non-STEM students' career choices. Based on the specific research models for STEM and non-STEM students, there were similarities and differences in the factors influencing students' career choice. The main difference noted in the finding indicates that STEM students' career choices were positively influenced by internal factors like perceived behavioural control, whereas non-STEM students were negatively affected by external factors like financial reward. By considering the differences between STEM and non-STEM students' career choice intention, educators and policy makers could tailor distinctive strategies to facilitate students' career pathways to the STEM workforce. Since STEM students regarded perceived behavioural control important to their career choice intention, teachers can conduct class activities that facilitate students to develop confidence and upskill their STEM abilities. As they gain more confidence and believe in their abilities, they are more likely to have greater likelihood to pursue STEM in future. On the other hand, though financial reward only significantly influenced career choice intention among non-STEM students, the causal relationship was negative. This implies that non-STEM students consider high pay as high risk which good salary is perceived as a threat that impedes their likelihood to opt for a career in STEM. Therefore, good income should not be emphasised in the effort to promote STEM careers to non-STEM students.

Instead, the influence of significant others and media exposure should be given the priority in alleviating students' career choice intention among non-STEM students. In particular, the policy makers, STEM advocates, industry players, STEM teachers, and career advisors could disseminate information about STEM careers through the media by considering the differences between STEM and non-STEM stream. As explained in Section 1.2.1, STEM students are trained to become STEM professionals, whereas non-STEM students are expected to become STEM associates. This means that non-STEM students should also be informed that they are welcomed to join the STEM workforce and be included in all STEM interventions that lead students to STEM industries. This kind of information can be disseminated to students through various channels such as infographics in course materials and short video clips spread through the social media.

5.5 Limitations and Recommendations for Future Research

While this study makes several valuable theoretical and practical contributions, there are several limitations that shall not be overlooked for further validation. Firstly, the initial plan of this study was to collect data offline through physical administration of questionnaires at schools. Due to the outbreak of the global pandemic during data collection, the research progress was greatly affected as schools were closed, and research activities had to be halted immediately. Hence, the data was recollected online as an alternate method to avoid further loss, particularly in cost and time. As the online questionnaire was administered via schoolteachers or school authorities due to access restrictions during the pandemic, the researcher did not have direct communication with the respondents. Indirect communication between the researcher and the respondents via school authorities and teachers could have potentially affected students' responses. It was noticed that a minority of teachers administered only one version of the bilingual questionnaire (either English or Malay) to the students based on their own preferences. As the bilingual questionnaire was prepared for students' clarity, this issue might have caused misinterpretation when students were restrained from choosing their preferred language while answering the survey. As such, the information they received may have varied during questionnaire administration as the instructions they received were restricted to details on the questionnaire, as well as the second-hand information from teachers.

In view of the limitation caused by the transition from offline to online data collection, it is suggested to conduct similar surveys offline to avoid intractable situations in the aforementioned. Without critical conditions such as the pandemic, it is advised to administer the questionnaires to students face-to-face to avoid misinterpretation of the survey, so that students can approach the researchers immediately if they need assistance while responding to the questionnaire. Direct communications with the teenage respondents could also help future researchers to avoid administrative issues. This would help to reduce potential threats which could risk the quality of data collected through indirect communication during questionnaire administration.

Besides, the limitation related to the external validity of this study should also be considered for future improvements. Regarding locality issues, the research findings in this study can only be generalised to all the states in Peninsular Malaysia. Although this study covered a majority regions in Malaysia, East Malaysia which consists of Sabah, Sarawak, and the Federal Territory of Labuan were exempted. Moreover, this study could have investigated both upper secondary school (Form Four and Form Five) students' career choices, but it was scoped to Form Four students due to access restrictions granted by the government officials. This is because Form Five students from the upper secondary level were in preparation for the national examination, Malaysian SPM. The exclusion of Form Five students was regarded as a limitation because students' pathway to STEM is formed during the high school (upper secondary) years where their career awareness increases dramatically (Wang & Degol, 2017). Since the scope was limited to only Form Four students, the representativeness of the study was affected wherein the findings cannot be generalised to all upper secondary students in Malaysia.

Therefore, future research is recommended to expand the geographical coverage of the study to East Malaysia or to other developing countries to augment the representativeness and generalisability of the research findings. In consideration of this limitation, the findings could be different in other contexts such as in primary schools, colleges and universities. Similar research could be duplicated in other disciplines such as accounting or humanities to ensure the hypothesised model is applicable to other settings. Future researchers could also expand the scope of research by including students from secondary school students in other countries, or Form Five in Malaysia with permission given. Form Five students are generally more mature than Form Four and are expected to have clearer ideas about their career decisions. This is because Form Five students are likely to have more experience in the upper secondary education and are exactly before the stage where they would decide their career pathway or tertiary education.

Additionally, a limitation on the internal validity in this study should also be considered for improvement of future research. The responses were collected from the students for only one time during the nascent implementation of the new curriculum. This implies that the data might not represent students' career choices of other time, even though the data were cross-sectioned across all states in Peninsular Malaysia. This could be a potential issue in terms of the generalisability of the findings because attitude and behaviour are prone to change over time (Gratton & Jones, 2014). Besides, the research was conducted during the early implementation of the new curriculum with STEM and non-STEM streams. As the education system matures over time, changes and adjustments are likely to be enacted to polish STEM initiatives under the national curriculum. As such, it is expected to affect students' experience and involvement which would also cause changes in their perception for STEM career choices.

Consequently, a longitudinal research design can be considered for future studies to enhance the causal relationships among constructs in explaining students' STEM career choice intention. This is because a longitudinal approach would allow researchers to detect students' behavioural changes as they develop their knowledge, exposure and experience with STEM over time (Castellanos, 2018; Shin et al., 2018). This approach is particularly useful to examine the changes in behaviour by considering the sequencing of events in accordance with time. For example, a longitudinal study can be carried out involving a group of students for each stream of study, starting from their enrolment to STEM and non-STEM stream to the end of their Form Five education to observe changes in their STEM career choice intention throughout their two-year experience in upper secondary school. This will help the researchers to identify the differences and unique behaviour of the respondents at one time than another, thus validating the research model at different points of time.

Another limitation of the present study was the lack of qualitative inputs. It is understood that qualitative approach is useful to complement quantitative approach by collecting more meaningful data that reflect students' perception towards STEM career choices. Although semi-structured and cognitive interviews were conducted prior to inferential data analysis of this study, the interviews were only done for questionnaire development but not for hypothesis testing. As such, the data was collected using close-ended questions that could have limited the respondents' freedom from providing more comprehensive responses which could better reflect their true perception towards STEM career choices. This could have caused biased responses as the respondents were restricted to respond based on the options given, but could not critically elaborate their opinions.

It is recommended to include a qualitative approach in future. This would allow prospective researchers to explore a more in-depth understanding towards students' STEM career choices that could not be explained using numerical evidence and statistical analyses. Qualitative data can also be gathered from teachers, parents and friends as well as STEM policy makers or curriculum developers to improve the breadth and comprehensiveness of the study. While quantitative approach is also indispensable, a combination of qualitative and quantitative approach would be ideal to complement the shortcomings of the respective technique. For example, focused-group interviews could be conducted with Form Four STEM and non-STEM stream students to further explore in what ways their career choices are different. This would offer valuable insights that reflect the actual perceptions between the two groups of students and provide more specific implications to the stakeholders for actual practices.

As this study used a large sample size ($n=786$; $n>150$), it was recommended to set the significance level (α) at .05 (Pallant, 2020). Though it is common to use the statistical significance level of .05 in educational and social science research (Cohen et al, 2017, Pallant et al., 2020), some researchers argued that the alpha level can be adjusted based on the research context to improve the interpretation of practical importance of the research (Maher et al., 2013). Indeed, Cohen et al. (2017) mentioned that effect size is often overlooked in educational research effect size, and this could lead to issues in the interpretation of results.

While practical significance is subjected to researchers' judgement and context, reporting the effect size of results could be an important approach in educational research (Maher et al., 2013). It was noted that the inclusion of effect sizes in results could help to increase the meaningfulness and practical significance (Peeters et al., 2013). For instance, the alpha level could be lowered to .01 in future research to set a higher limit for statistical significance (Cohen et al., 2017). This will increase the substantive significance of the results and help the audience to focus on the significance of educational findings (Cohen et al., 2017; Kirk, 1996). In other words, setting a more rigorous alpha level and reporting the effect size of the results can help the stakeholders such as policymakers, practitioners and researchers to better grasp the practical importance of the findings in real-life settings (Preacher & Kelly, 2011).

Lastly, it was noticed in this study that there was no clear evidence on how the streaming system was actually practised during the early implementation of the STEM-oriented curriculum. Based on the existing literature and accessible documents, little was known about how students were streamed at state and school levels despite the curriculum was implemented nationwide. Although it was known that students can choose elective subjects based on a list of packages provided by the MOE, schools are also given autonomy to offer elective subjects depending on the available facilities and resources in their schools (Mokhtar, 2019). It is not clear how students ended up in the stream of study they belonged to. For example, if students enrolled to either one of the streams of study because of the available resources of the schools, then students' perceptions towards STEM careers could have been different.

Therefore, future researchers should consider how the streaming is actually carried out in schools and reflect on the practical issues that relate to the students' perceptions towards their career choice in STEM. It is also anticipated that evidence or reports can be documented to explain how students are truly enrolled to STEM or non-STEM stream – whether it is based on their decision or academic performance. Addressing these grey areas in the new streaming system will help future researchers to better grasp the actual scenario of this streaming system and discuss students' controllability over their career choice in STEM. This will also help researchers to articulate how students' career choice intention are relatively different according to their streams of study.

5.6 Conclusion

In conclusion, the final chapter of this study has presented the discussions of the findings from various aspects. Overall, this study successfully developed one comprehensive and two specified TPB-based models (STEM and non-STEM) to predict secondary school students' career choice intention. Besides, the integration of media exposure, financial reward and career interest into the model offered new perspectives in career choice research. Corresponding the research questions, this study found that (a) all proposed antecedents except career interest significantly influenced students' STEM career choice intention in which subjective norms was the strongest predictor, (b) attitude towards career choice as the only significant mediator in the model, and (c) a significant difference in STEM and non-STEM students' career choice was confirmed.

The findings address factors that are important in students' STEM career choice and disprove the myths about career interest and financial reward that are no longer valid in today's scenario in STEM career choice. Instead, modern perspectives like media exposure should be given extra attention, while the roles of significant others remain relevant in the present world. These findings are particularly useful in consideration of the implementation of KSSM. As reformation in education is taking place to reinstate the importance of STEM in Malaysia in view of high demands in STEM industries, this research provides an up-to-date understanding of students' career choice as the results and findings are reflective of the current STEM curriculum. Referring to the research outcomes, the limitations of the research presented in the final chapter of this thesis should also be noted for future improvements.

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APPENDIX A

SAMPLING

Appendix A1: List of State Education Departments

No	Name of State Education Department (Jabatan Pendidikan Negeri, JPN)
1	Jabatan Pendidikan Negeri Perak
2	Jabatan Pendidikan Negeri Selangor
3	Jabatan Pendidikan Negeri Pahang
4	Jabatan Pendidikan Negeri Kelantan
5	Jabatan Pendidikan Negeri Terengganu
6	Jabatan Pendidikan Negeri Johor
7	Jabatan Pendidikan Negeri Kedah
8	Jabatan Pendidikan Negeri Melaka
9	Jabatan Pendidikan Negeri Perlis
10	Jabatan Pendidikan Negeri Sembilan
11	Jabatan Pendidikan Negeri Pulau Pinang
12	Jabatan Pendidikan Putrajaya
13	Jabatan Pendidikan Kuala Lumpur

Appendix A2: Sample Size Calculation

Region	State	Population* Non-STEM Humanities	Religious	Subtotal (N)	%	Population* STEM MPV (Vocational subjects)	Pendidikan Vokasional Menengah Atas (PVMA) Programme	Technology	Technical	Skills	Science	Subtotal (N)	%
Central	Selangor	32217	729	32946	20%	1214	283	16003	0	194	15239	32933	26%
	WP Kuala Lumpur	8084	113	8197	5%	732	128	2281	329	30	4234	7734	6%
	WP Putrajaya	754	0	754	0%	19	24	158	0	0	471	672	1%
South	Johor	24540	714	25254	16%	922	578	7474	303	185	9207	18669	15%
	Negeri Sembilan	8200	254	8454	5%	920	187	1360	298	67	3594	6426	5%
	Melaka	6324	215	6539	4%	723	233	1443	300	0	2431	5130	4%
North	Perak	15951	566	16517	10%	966	264	4376	0	201	7411	13218	11%
	Kedah	15742	1128	16870	10%	1057	275	2626	246	165	5183	9552	8%
	Pulau Pinang	9885	334	10219	6%	798	91	1665	278	8	5368	8208	7%
	Perlis	1634	73	1707	1%	275	94	577	0	0	596	1542	1%
East Coast	Kelantan	13060	428	13488	8%	918	400	1444	0	26	4870	7658	6%
	Pahang	11115	131	11246	7%	1152	148	942	221	231	4151	6845	5%
	Terengganu	9808	413	10221	6%	708	292	1552	265	39	4179	7035	6%
	Subtotal	157,314	5,098	162,412	100%	10,404	2,997	41,901	2,240	1,146	66,934	125622	100%
	Proportion (%)	56%				44%							
	Total	288,034											

Region	State	Target sample Non-STEM Calculated sample (n)	Calculated Sample (Rounded-off)	%	Target sample STEM Calculated sample (n)	Calculated Sample (Rounded-off)	%	Collected sample Non-STEM Collected Sample (n)	%	Collected sample STEM Collected Sample (n)	%	Final sample Non-STEM Final Sample (n)	%	Final sample STEM Final Sample (n)	%
Central	Selangor	45.85	45	20%	45.62	46	26%	90	19.91%	92	25.99%	87	19.73%	89	25.80%
	WP Kuala Lumpur	11.41	11	5%	10.71	11	6%	22	4.87%	22	6.21%	20	4.54%	22	6.38%
	WP Putrajaya	1.05	1	0%	0.93	1	1%	2	0.44%	2	0.56%	2	0.45%	2	0.58%
South	Johor	35.14	36	16%	25.86	26	15%	72	15.93%	52	14.69%	69	15.65%	46	13.33%
	Negeri Sembilan	11.76	12	5%	8.90	9	5%	24	5.31%	18	5.08%	24	5.44%	18	5.22%
	Melaka	9.10	9	4%	7.11	7	4%	18	3.98%	14	3.95%	18	4.08%	14	4.06%
North	Perak	22.98	23	10%	18.31	19	11%	46	10.18%	38	10.73%	45	10.20%	38	11.01%
	Kedah	23.47	23	10%	13.23	14	8%	46	10.18%	28	7.91%	45	10.20%	28	8.12%
	Pulau Pinang	14.22	14	6%	11.37	12	7%	28	6.19%	24	6.78%	28	6.35%	24	6.96%
	Perlis	2.38	3	1%	2.14	2	1%	6	1.33%	4	1.13%	6	1.36%	4	1.16%
East Coast	Kelantan	18.77	19	8%	10.61	11	6%	38	8.41%	22	6.21%	38	8.62%	22	6.38%
	Pahang	15.65	16	7%	9.48	9	5%	32	7.08%	18	5.08%	32	7.26%	18	5.22%
	Terengganu	14.22	14	6%	9.74	10	6%	28	6.19%	20	5.65%	27	6.12%	20	5.80%
	Subtotal	226	226	100%	174	177	100%	452	100.0%	354	100.0%	441	100.0%	345	100.0%
	Proportion (%)	56%			44%			56%		44%		56%		44%	
	Total	400						806				786			

*Information retrieved from Malaysia Educational Statistics 2019

APPENDIX B

LETTERS OF AUTHORITY

Appendix B1: Ethical Clearance

UNIVERSITI TUNKU ABDUL RAHMAN
Wholly Owned by UTAR Education Foundation (Company No. 578227-M)

Re: U/SERC/205/2019

9 October 2019

Dr Priscilla Moses
Department of General Studies
Faculty of Creative Industries
Universiti Tunku Abdul Rahman
Jalan Sungai Long
Bandar Sungai Long
43000 Kajang, Selangor

Dear Dr Priscilla,

Ethical Approval For Research Project/Protocol

We refer to your application for ethical approval for your research project (PhD student's project) and are pleased to inform you that your application has been approved under expedited review.

The details of your research project are as follows:

Research Title	STEM: Antecedents of Secondary School Students' Career Choices in Peninsular Malaysia
Investigator(s)	Dr Priscilla Moses Dr Cheah Phaik Kin Tiny Tey Chiu Yuen (UTAR Postgraduate Student)
Research Area	Social Sciences
Research Location	Secondary Schools in Peninsular Malaysia
No of Participants	800 participants (Age: 15 - 18)
Research Costs	Self-funded
Approval Validity	9 October 2019 - 8 October 2020

The conduct of this research is subject to the following:

(1) The participants' informed consent be obtained prior to the commencement of the research;

(2) Confidentiality of participants' personal data must be maintained; and

(3) Compliance with procedures set out in related policies of UTAR such as the UTAR Research Ethics and Code of Conduct, Code of Practice for Research Involving Humans and other related policies/guidelines.

Kampar Campus : Jalan Universiti, Bandar Barat, 31900 Kampar, Perak Darul Ridzuan, Malaysia
Tel: (605) 468 8888 Fax: (605) 466 1313
Sungai Long Campus : Jalan Sungai Long, Bandar Sungai Long, Cheras, 43000 Kajang, Selangor Darul Ehsan, Malaysia
Tel: (603) 9086 0288 Fax: (603) 9019 8868
Website: www.utar.edu.my

Appendix B2: Approval Letter from the Ministry of Education

KEMENTERIAN PENDIDIKAN MALAYSIA
MINISTRY OF EDUCATION MALAYSIA
BAHAGIAN PERANCANGAN DAN PENYELIDIKAN DASAR PENDIDIKAN
EDUCATIONAL PLANNING AND RESEARCH DIVISION
Aras 1-4, Blok E8
Kompleks Kerajaan Parcel E
Pusat Pentadbiran Kerajaan Persekutuan
62604 Putrajaya

Telefon : 03-8884 6500
Faks : 03-8884 6439
Laman Web : www.moe.gov.my

Ruj. Kami : KPM.100-15/2/135(50)
Tarikh : 17 Jun 2020

TINY TEY CHIU YUEN
K.P.:910918045054

FACULTY OF CREATIVE INDUSTRIES
UNIVERSITI TUNKU ABDUL RAHMAN
BANDAR SUNGAI LONG
43200 KAJANG
SELANGOR

Tuan,

KELULUSAN BERSYARAT UNTUK MENJALANKAN KAJIAN :
STEM: ANTECEDENTS OF SECONDARY SCHOOL STUDENTS' CAREER CHOICES IN PENINSULAR MALAYSIA

Perkara di atas adalah dirujuk.

2. Sukacita dimaklumkan bahawa permohonan tuan untuk menjalankan kajian seperti di bawah telah diluluskan dengan syarat:

> **" KELULUSAN INI BERGANTUNG KEPADA PERTIMBANGAN PENTADBIR SEKOLAH. 2. MAKLUMAT KAJIAN DAN PENGKAJI HENDAKLAH DINYATAKAN DALAM BORANG SOAL SELIDIK. 3. INSTRUMEN KAJIAN DISEDIAKAN DALAM DWI BAHASA (BAHASA INGGERIS DAN BAHASA MELAYU) "**

3. Kelulusan ini adalah berdasarkan kepada kertas cadangan penyelidikan dan instrumen kajian yang dikemukakan oleh tuan kepada Bahagian ini. Walau bagaimanapun kelulusan ini bergantung kepada kebenaran Jabatan Pendidikan Negeri dan Pengetua / Guru Besar yang berkenaan.

4. Surat kelulusan ini sah digunakan bermula dari **1 Ogos 2020 hingga 31 Januari 2021.**

5. Tuan juga mesti menyerahkan senaskhah laporan akhir kajian dalam bentuk *hardcopy* bersama salinan *softcopy* berformat Pdf di dalam CD kepada Bahagian ini. Tuan diingatkan supaya mendapat kebenaran terlebih dahulu daripada Bahagian ini sekiranya dapatan kajian tersebut hendak dibentangkan di mana-mana forum, seminar atau diumumkan kepada media massa.

Sekian untuk makluman dan tindakan tuan selanjutnya. Terima kasih.

"BERKHIDMAT UNTUK NEGARA"

Saya yang menjalankan amanah,

(DR. VASUNDHARA A/P VASUDEVAN)
Ketua Penolong Pengarah Kanan
Sektor Penyelidikan dan Penilaian Dasar
b.p. Pengarah
Bahagian Perancangan dan Penyelidikan Dasar Pendidikan
Kementerian Pendidikan Malaysia

QUALITY SYSTEM SIRIM IQNet
CERTIFIED TO ISO 9001:2015

Appendix B3: Approval Letters from State Education Departments

KEMENTERIAN PENDIDIKAN MALAYSIA
Jabatan Pendidikan Negeri Sembilan,
Jalan Dato' Hamzah, Karung Berkunci No.6,
70990 Seremban, Negeri Sembilan Darul Khusus.

Tel : 06-7653100
Faks : 06-7639969
Laman Web : jpnns.moe.gov.my

Ruj. Kami : JPNS.SPS.PM.100-2/5 Jld. 4(5)
Tarikh : 06 OGOS 2020

TINY TEY CHIU YUEN
NO. KP : 910918045054
FACULTY OF CREATIVE INDUSTRIES
UNIVERSITI TUNKU ABDUL RAHMAN
BANDAR SUNGAI LONG
43200 KAJANG SELANGOR

Tuan/Puan,

KEBENARAN MENJALANKAN KAJIAN KE SEKOLAH-SEKOLAH DI NEGERI SEMBILAN DARUL KHUSUS DI BAWAH KEMENTERIAN PENDIDIKAN MALAYSIA

Saya dengan segala hormatnya memaklumkan bahawa permohonan tuan/puan untuk menjalankan kajian bertajuk: **"STEM: ANTECEDENTS OF SECONDRY SCHOOL STUDENTS' CAREER CHOICES IN PENINSULAR MALAYSIA"** telah **diluluskan dengan syarat : "KELULUSAN INI BERGANTUNG KEPADA PERTIMBANGAN PENTADBIR SEKOLAH. 2. MAKLUMAT KAJIAN DAN PENGKAJI HENDAKLAH DINYATAKAN DALAM BORANG SOAL SELIDIK 3. INSTRUMEN KAJIAN DISEDIAKAN DALAM DWIBAHASA (BAHASA INGGERIS DAN BAHASA MELAYU)"**

2. Tuan/Puan hendaklah menghubungi dengan Pengetua sekolah berkenaan untuk meminta persetujuan dan membincangkan kajian tersebut di tempat seperti berikut:

i. **Sekolah Menengah, Daerah Seremban**

3. Dimaklumkan bahawa kebenaran ini diberikan berdasarkan surat kelulusan dari pihak Kementerian Pendidikan Malaysia, Bahagian Perancangan Dan Penyelidikan Dasar Pendidikan, nombor rujukan KPM.100-15/2/135 (50) bertarikh 17 Jun 2020 dan **sah digunakan bermula dari 01 Ogos 2020 hingga 31 Januari 2021.**

4. Tuan/Puan hendaklah menghantar satu naskah hasil kajian dalam bentuk *hardcopy* bersama salinan *softcopy* berformat Pdf di dalam CD ke Jabatan Pendidikan Negeri Sembilan (u.p : Unit Menengah).

Sekian untuk makluman dan tindakan tuan/puan selanjutnya. Terima kasih.

'BERKHIDMAT UNTUK NEGARA'
'BERSIH . MUAFAKAT . SEJAHTERA'

Saya yang menjalankan amanah,

(HAJI MD FIAH BIN MD JAMIN)
Pengarah Pendidikan
Jabatan Pendidikan Negeri Sembilan

S.K. 1. Pengetua sekolah berkenaan
2. Pegawai Pendidikan Daerah, Pejabat Pendidikan Daerah

Nota :- Sila beri satu salinan surat kelulusan semasa membuat kajian di sekolah

KEMENTERIAN PENDIDIKAN MALAYSIA
Jabatan Pendidikan Wilayah Persekutuan Kuala Lumpur
Persiaran Tuanku Syed Sirajuddin
50604 Kuala Lumpur

Tel : 03 6204 6000
Fax : 03 6204 6801
Portal : jpnpkl.moe.gov.my
E-mel : jpn.wp@moe.gov.my

Ruj.Kami : JPNWP.900-6/1/7 Jld 25 (63)
Tarikh : 19 Ogos 2020

Tiny Tey Chiu Yuen
Faculty Og Creative Industries
Universiti Tunku Abdul Rahman, Bandar Sungai Long
43200 Kajang, Selangor

Tuan,

KEBENARAN UNTUK MENJALANKAN KAJIAN DI SEKOLAH-SEKOLAH, PEJABAT PENDIDIKAN DAERAH DAN JABATAN PENDIDIKAN WILAYAH PERSEKUTUAN KUALA LUMPUR

Dengan segala sukacitanya saya merujuk kepada perkara di atas. Surat tuan dan surat kebenaran daripada Bahagian Perancangan dan Penyelidikan Dasar Pendidikan, Kementerian Pendidikan Malaysia bil (50) dalam KPM.100-15/2/135 bertarikh 17 Jun 2020 adalah berkaitan.

2. Dimaklumkan bahawa permohonan tuan untuk menjalankan kajian bertajuk "***STEM: ANTECEDENTS OF SECONDARY SCHOOL STUDENTS' CAREER CHOICES IN PENINSULAR MALAYSIA***" diluluskan dan tuan adalah tertakluk di bawah syarat-syarat berikut:

2.1 Kelulusan ini adalah tertakluk kepada kandungan dalam cadangan penyelidikan yang telah diluluskan oleh Kementerian Pendidikan Malaysia;
2.2 Sila kemukakan surat kebenaran ini ketika berurusan dengan pihak pengurusan di Sektor/Pejabat Pendidikan Wilayah atau Pengetua/Guru Besar di sekolah berkenaan;
2.3 Kebenaran ini bergantung kepada pertimbangan pihak pentadbir sekolah berkenaan;
2.4 Kelulusan ini hanya untuk sekolah-sekolah di bawah pentadbiran Jabatan Pendidikan Wilayah Persekutuan Kuala Lumpur sahaja;
2.5 Maklumat penyelidik dimasukkan dalam instrumen kajian;
2.6 Tuan hendaklah mengemukakan senaskhah hasil kajian kepada Jabatan ini sebaik sahaja ia siap sepenuhnya;
2.7 Instrumen kajian disediakan dalam dwi bahasa (Bahasa Inggeris dan Bahasa Melayu).

3. Kebenaran ini adalah untuk tujuan dipohon sahaja dan sah digunakan bermula dari **01 Ogos 2020** hingga **31 Januari 2021.**

4. Bagi mengelakkan penularan Covid-19, tuan/puan dinasihatkan agar sentiasa mengamalkan penjarakan fizikal dan memastikan penjagaan kebersihan diri semasa membuat kajian di sekolah-sekolah tersebut.

Sekian, terima kasih.

" BERKHIDMAT UNTUK NEGARA "

Saya yang menjalankan amanah,

(MOHD NAJIB BIN AB. RAHMAN, KMW)
Timbalan Pengarah Pendidikan,
Sektor Perancangan dan Pengurusan PPD
b.p Pengarah Pendidikan,
Jabatan Pendidikan Wilayah Persekutuan Kuala Lumpur.

Nur Asiah binti Che Lah

s.k - Pegawai Pendidikan Daerah, Pejabat Pendidikan Daerah Bangsar/Pudu, Kuala Lumpur
- Fail

KEMENTERIAN PENDIDIKAN MALAYSIA
Jabatan Pendidikan Negeri Selangor
Jalan Jambu Bol 4/3E, Seksyen 4
40604 Shah Alam, Selangor

Tel : 03-5518 6500
Faks : 03-5510 2133
Laman Web : *jpnselangor.moe.gov.my*

Rujukan Kami : JPNS.SPD.600-1/1/2 JLD.9(32)
Tarikh : 26/08/2020

TINY TEY CHIU YUEN
FACULTY OF CREATIVE INDUSTRIES
UNIVERSITI TUNKU ABDUL RAHMAN
BANDAR SUNGAI LONG, CHERAS,
43000 KAJANG,
SELANGOR

Tuan,

KELULUSAN BERSYARAT UNTUK MENJALANKAN KAJIAN : STEM: ANTECEDENTS OF SECONDARY SCHOOL STUDENTS' CAREER CHOICES IN PENINSULAR MALAYSIA

Perkara di atas dengan segala hormatnya dirujuk.

2. Sukacita dimaklumkan bahawa permohonan tuan untuk menjalankan kajian seperti tersebut di atas telah diluluskan dengan syarat:

"1. KELULUSAN INI BERGANTUNG KEPADA PERTIMBANGAN PENTADBIR SEKOLAH. 2. MAKLUMAT KAJIAN DAN PENGKAJI HENDAKLAH DINYATAKAN DALAM BORANG SOAL SELIDIK. 3. INSTRUMEN KAJIAN DISEDIAKAN DALAM DWI BAHASA (BAHASA INGGERIS DAN BAHASA MELAYU)."

3. Pihak tuan diingatkan agar mendapat persetujuan daripada Pengetua/Guru Besar supaya beliau dapat bekerjasama dan seterusnya memastikan bahawa penyelidikan dijalankan hanya bertujuan seperti yang dipohon. Kajian/Penyelidikan yang dijalankan juga tidak mengganggu perjalanan sekolah serta tiada sebarang unsur paksaan.

4. **Surat kelulusan ini sah digunakan bermula dari 1 Ogos 2020 hingga 31 Januari 2021**

5. Tuan juga diminta menghantar senaskah hasil kajian ke Sektor Perancangan dan Pengurusan PPD, Jabatan Pendidikan Selangor sebaik selesai penyelidikan/kajian.

Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA"

Saya yang menjalankan amanah,

(HAJI IZMI BIN HAJI ISMAIL, A.M.P., P.J.K.)
Pengarah Pendidikan
Jabatan Pendidikan Negeri Selangor

s.k: - Fail

KEMENTERIAN PENDIDIKAN MALAYSIA
Jabatan Pendidikan Negeri Melaka
Jalan Istana, Bukit Beruang
75450 Melaka

Tel : 06-2323777
Faks : 06-2320500
Laman Web : http://jpnmelaka.moe.gov.my

Ruj. Kami : JPNM.SPS.MT6.600-11/2/1 (20)
Tarikh : 14 Februari 2020

Tiny Tey Chiu Yuen,
Penyelidik Doktor Falsafah,
Faculty of Creative Industries,
Universiti Tunku Abdul Rahman (UTAR),
Sungai Long Campus, Jalan Sungai Long,
Bandar Sungai Long, Cheras, 43000 Kajang,
Selangor Darul Ehsan.

Tuan,

KEBENARAN MENJALANKAN KAJIAN DI SEKOLAH-SEKOLAH MENENGAH NEGERI MELAKA

Dengan segala hormatnya merujuk kepada surat tuan mengenai perkara di atas.

2. Sukacita dimaklumkan bahawa Jabatan ini tiada halangan bagi pihak tuan untuk menjalankan kajian yang bertajuk;

" STEM: Antecedents of Secondary School Students' Carrer Choices in Peninsular Malaysia" diluluskan.

3. Dimaklumkan juga di sini bahawa kajian ini adalah semata-mata untuk memenuhi syarat kursus yang diduduki sahaja dan bukan untuk tujuan lain.

4. Surat kelulusan ini sah digunakan bermula **3 Februari 2020 sehingga 31 Julai 2020.**

5. Walau bagaimanapun, pihak tuan adalah dinasihatkan menghubungi pihak Pengetua/ Guru Besar sekolah terlebih dahulu untuk berbincang dan mendapatkan persetujuan. Sebarang pertanyaan, sila hubungi sila hubungi Encik Azli bin Musalleh di talian 06-2310296 (Penolong Pengarah, Unit Menengah dan Tingkatan 6).

Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA"
"MELAKA BERWIBAWA"
"PINTAR, HIJAU, BERSIH"

Saya yang menjalankan amanah,

(HAJI KARIM BIN TUMIN)
Timbalan Pengarah Pendidikan
Sektor Pengurusan Sekolah
Jabatan Pendidikan Negeri Melaka
b.p Pengarah Jabatan Pendidikan

"Pendidikan Berkualiti, Insan Terdidik, Negara Sejahtera"

JABATAN PENDIDIKAN NEGERI PERLIS
Jalan Tun Abdul Razak
01990 Kangar
PERLIS

NO. TEL PEJABAT : 04-973 7777
PENGARAH : 04-973 7644
NO. FAKS : 04-976 7080
JPN CAWANGAN : 04-976 7410
LAMAN WEB : www.jpnperlis.gov.my

Rujukan kami : JPNPs.SP.600 - 1/1/1 (4)

Tarikh : 10 Ogos 2020

Tiny Tey Chiu Yuen,
Faculty of Creative Industries,
Universiti Tunku Abdul Rahman (UTAR),
Sungai Long Campus, Jalan Sungai Long,
Bandar Sungai Long,
43000 Kajang,
SELANGOR

Tuan,

PERMOHONAN MENJALANKAN KAJIAN DI SEKOLAH-SEKOLAH MENENGAH

Dengan hormatnya saya merujuk surat tuan bertarikh 28 Julai 2020 berkaitan perkara di atas.

2. Sukacita dimaklumkan bahawa, Jabatan ini tiada apa-apa halangan menjalankan kajian bertajuk **"STEM : ANTECEDENTS O SECONDARY SCHOOL STUDENTS' CAREER CHOICES IN PENISULAR MALAYSIA."**

3. Kelulusan ini adalah berdasarkan kepada apa yang terkandung di dalam kertas cadangan yang tuan kemukakan ke Kementerian Pendidikan Malaysia dan kebenaran ini adalah tertakluk kepada persetujuan Pengetua/Guru Besar sekolah-sekolah berkenaan. Sila patuhi kelulusan bersyarat seperti surat KPM. 100-15/2/135 (50) bertarikh 17 Jun 2020.

4. Sehubungan dengan itu, tuan/puan/encik/cik dikehendaki menghantar senaskah penyelidikan ke jabatan ini sebaik sahaja selesai penyelidikan tersebut.

5. Segala maklumat yang diperolehi dari kajian ini adalah sulit dan tidak boleh dihebahkan kepada mana-mana pihak. **Tuan juga dipohon untuk menghantar sesalinan soalan kajian ke jabatan ini sebelum ianya dilaksanakan di sekolah yang terlibat.**

6. Pemohon **HANYA** boleh menjalankan kajian dan mengumpul data secara atas talian atau melalui google form sekiranya Perintah Kawalan Pergerakkan masih berkuatkuasa.

2/....

KEMENTERIAN PENDIDIKAN MALAYSIA
JABATAN PENDIDIKAN NEGERI KEDAH
KOMPLEKS PENDIDIKAN, JALAN STADIUM
05604 ALOR SETAR
KEDAH DARUL AMAN

Telefon : 04-740 4000
Faks : 04-740 4342
Laman Web : www.moe.gov.my

Ruj.Kami : JPK.SPS.UPP 600-1/1/2 Jld. 12 (01)
Tarikh : 16 Ogos 2020

TINY TEY CHIU YEN
K/P: 910918045054

Tuan / Puan,

KEBENARAN UNTUK MENJALANKAN KAJIAN/PENYELIDIKAN DI SEKOLAH-SEKOLAH DI NEGERI KEDAH

Saya dengan hormatnya diarah merujuk kepada perkara tersebut di atas.

2. Dimaklumkan bahawa permohonan tuan / puan untuk menjalankan penyelidikan yang bertajuk **"STEM: ANTECEDENTS OF SECONDARY SCHOOL STUDENT'S CAREER CHOICES IN PENINSULAR MALAYSIA."** telah ***diluluskan***.

3. Kelulusan ini adalah berdasarkan kepada apa yang terkandung di dalam cadangan penyelidikan yang tuan / puan kemukakan ke Kementerian Pendidikan Malaysia. Tuan / puan dikehendaki mengemukakan senaskah laporan akhir kajian setelah selesai kelak dan diingatkan supaya mendapat kebenaran terlebih dahulu daripada Jabatan ini sekiranya sebahagian atau sepenuhnya dapatan kajian tersebut hendak dibentangkan di mana-mana forum, seminar atau diumumkan kepada media.

4. Kebenaran ini adalah tertakluk kepada persetujuan Pengetua / Guru Besar sekolah berkenaan dan adalah **sah 1 Ogos 2020 hingga 31 Januari 2021 sahaja.**

Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA"
"PENDIDIKAN CEMERLANG KEDAH TERBILANG"

Saya yang menjalankan amanah,

(MD TAJUDIN BIN HAJI MORAD, BCK.)
Penolong Pendaftar Institusi Pendidikan Dan Guru
Jabatan Pendidikan Negeri Kedah
b.p. Ketua Pendaftar Institusi Pendidikan Dan Guru
Kementerian Pendidikan Malaysia

KEMENTERIAN PENDIDIKAN MALAYSIA
Jabatan Pendidikan Negeri Pahang
Bandar Indera Mahkota
25604 Kuantan
Pahang Darul Makmur

Tel : 09-5715700
Faks : 09-5734857
Laman Web : *jpnpahang.moe.gov.my*

Rujukan Kami : JPNP.SPS.600-1 (**2**)
Tarikh : 19 Februari 2020
25 Jamadilakhir 1441H

TINY TEY CHIU YUEN
FACULTY OF CREATIVE INDUSTRIES
UNIVERSITI TUNKU ABDUL RAHMAN (UTAR)
SUNGAI LONG CAMPUS
JALAN SUNGAI LONG
BANDAR SUNGAI LONG
43000 KAJANG

Tuan,

KELULUSAN BERSYARAT UNTUK MENJALANKAN KAJIAN :
STEM : ANTECEDENTS OF SECONDARY SCHOOL STUDENTS' CAREER CHOICES IN PENINSULAR MALAYSIA

Dengan segala hormatnya, perkara di atas dirujuk.

2. Sehubungan dengan itu, pihak kami **TIADA HALANGAN** untuk memberi kelulusan menjalankan kajian dengan syarat;

" 1. KELULUSAN INI BERGANTUNG KEPADA PERTIMBANGAN PENTADBIR SEKOLAH. 2. MAKLUMAT KAJIAN DAN PENGKAJI HENDAKLAH DINYATAKAN DALAM BORANG SOAL SELIDIK. 3. INSTRUMEN KAJIAN DISEDIAKAN DALAM DWI BAHASA (BAHASA INGGERIS DAN BAHASA MELAYU) "

3. Kelulusan ini hanya untuk tujuan dan tempat kajian **yang dipohon sahaja dan sah digunakan mulai 03 Februari 2020 hingga 31 Julai 2020**. Tuan boleh terus membuat perbincangan dengan pihak sekolah yang terlibat dalam pelaksanaan kajian ini. Tuan juga diminta menghantar senaskhah laporan akhir kajian setelah selesai kajian.

Semoga apa yang dirancang beroleh kejayaan.

Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA"

Saya yang menjalankan amanah,

(HAIRUNIZAM BIN HUSSEIN)
Penolong Pengarah (Sekolah Jenis Khas)
Sektor Pengurusan Sekolah
b.p. Pengarah Pendidikan Pahang

s.k.
1. Pengarah Pendidikan Pahang
2. Timbalan Pengarah Pendidikan Pahang
3. Ketua Sektor Pengurusan Sekolah
4. Pejabat Pendidikan Daerah :
5. Pengetua / Guru Besar : -
6. Fail Timbul

KEMENTERIAN PENDIDIKAN MALAYSIA
Jabatan Pendidikan Negeri Kelantan
Bandar Baru Tunjong,
16010 Kota Bharu, Kelantan.

Tel : 09-741 8000
Fax : 09-748 2554
Website : jpnkelantan.moe.gov.my

Ruj. Kami : JPKn/SPS/UPP.500/3/3/7Jld 1 (46)
Tarikh : OGOS 2020

TINY TEY CHIU YUEN
FACULTY OF CREATIVE INDUSTRIES
UNIVERSITI TUNKU ABDUL RAHMAN
BANDAR SUNGAI LONG
43200 KAJANG
SELANGOR

Tuan,

KEBENARAN UNTUK MENJALANKAN KAJIAN DI SEKOLAH, INSTITUSI PENDIDIKAN GURU, JABATAN PENDIDIKAN NEGERI DAN BAHAGIAN KEMENTERIAN PENDIDIKAN MALAYSIA

Adalah saya dengan hormatnya merujuk surat permohonan tuan/puan mengenai perkara di atas.

2. Surat kebenaran dari Pengarah Bahagian Perancangan & Penyelidikan Dasar Pendidikan, Kementerian Pendidikan Malaysia, Rujukan : KPM.100-15/2/135 (50) bertarikh 17 Jun 2020 berkaitan.

3. Jabatan Pendidikan Negeri Kelantan tiada halangan bagi tuan/puan menjalankan kajian/penyelidikan seperti tajuk:

"STEM : ANTECEDENTS OF SECONDARY SCHOOL STUDENTS CAREER CHOICES IN PENINSULAR MALAYSIA" diluluskan.

4. Kelulusan ini adalah dihadkan berdasarkan kepada tajuk kajian / penyelidikan yang dikemukakan ke Jabatan ini bagi tempoh sehingga **31 Januari 2021.**

5. Sekolah-sekolah yang terlibat adalah: **Sekolah-Sekolah di Negeri Kelantan.**

6. Tuan / Puan dinasihatkan supaya terlebih dahulu berbincang dengan Pengetua / Guru Besar sekolah-sekolah berkenaan sebelum kajian /penyelidikan dijalankan.

Sekian, terima kasih.

"RAJA BERDAULAT, RAKYAT MUAFAKAT, NEGERI BERKAT"
"BERKHIDMAT UNTUK NEGARA"

Saya yang menjalankan amanah,

MOHD ZIN BIN HALIM
Ketua Penolong Pengarah Kanan
Sektor Pengurusan Sekolah
Jabatan Pendidikan Negeri Kelantan

s.k

i. Pengarah Pendidikan Kelantan.
ii. Pengarah, Bahagian Perancangan & Penyelidikan Dasar Pendidikan. Kementerian Pendidikan Malaysia.
iii. Pegawai Pendidikan Daerah: PPD berkenaan.
iv. Pengetua / Guru Besar Sekolah berkenaan

KEMENTERIAN PENDIDIKAN MALAYSIA
Jabatan Pendidikan Wilayah Persekutuan Putrajaya
Aras 7, Blok E2, Kompleks E
Pusat Pentadbiran Kerajaan Persekutuan
62604 Putrajaya

Tel. : 03-88890000
Faks. : 03-88903087
Laman Web : www.moe.gov.my

Ruj. Kami : JPWPP.100-2/2/2 Jld. 5 ( )
Tarikh : 4 Mac 2020

Tiny Tey Chiu Yuen
Faculty of Creative Industries
Universiti Tunku Abdul Rahman
Bandar Sungai Long
43200 Kajang
Selangor.

Tuan,

PERMOHONAN MENJALANKAN KAJIAN DI SEKOLAH MENENGAH WILAYAH PERSEKUTUAN PUTRAJAYA

Dengan hormatnya perkara di atas dirujuk.

2. Sukacita dimaklumkan bahawa pihak Jabatan tiada halangan atas permohonan pihak tuan menjalankan kajian penyelidikan sarjana di SK Putrajaya Presint 8 (2), SK Putrajaya Presint 9 (2), SK Putrajaya Presint 14 (1) dan SK Putrajaya Presint 16 (2):

Nama : **Tiny Tey Chiu Yuen**
No. K/P : **910918045054**
Tajuk Kajian : ***STEM : Antecedents of Secondary School Students' Career Choices in Peninsular Malaysia***

3. Walaubagaimana pun, pihak tuan perlu mematuhi syarat-syarat berikut:

3.1 Kelulusan ini bergantung kepada pertimbangan pentadbir sekolah;
3.2 Maklumat Kajian dan Pengkaji hendaklah dinyatakan dalam boring kaji selidik;
3.3 Instrumen kajian disediankan dalam dwi bahawa (Bahasa Inggeris dan Bahasa Melayu;
3.4 Perlu berhubung dengan Pengetua sekolah-sekolah berkenaan.

4. Kebenaran ini hanya untuk tujuan yang dipohon dan luput selepas tarikh **31 Julai 2020.**

Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA"

Saya yang menjalankan amanah,

(HAJAH FARIZAH BINTI HAJI AHMAD)
Pengarah
Jabatan Pendidikan Wilayah Persekutuan Putrajaya

KEMENTERIAN PENDIDIKAN MALAYSIA
Jabatan Pendidikan Negeri Johor
Jalan Tun Abdul Razak
80604, Johor Bahru
Johor Darul Ta'zim
e-mel : jpn.johor@moe.gov.my

Telefon	: 07-231 0000
Pengarah	: 07-231 0198
Timbalan	: 07-231 0191
Faks	: 07-234 7132
Laman Web	: www.jpnjohor.moe.gov.my
E-mel	: jpn.johor@moe.gov.my

Rujukan Kami: JPNJ.PS.600-1/1/2 Jld 4 (6)
Tarikh : 13 Oktober 2020

Encik / Puan / Cik: Tiny Tey Chiu Yuen
Faculty of Creative Industries
Universiti Tunku Abdul Rahman
Bandar Sungai Long
43200 Kajang
Selangor

Tuan,

**KELULUSAN BERSYARAT UNTUK MENJALANKAN KAJIAN:
STEM: ANTECEDENTS OF SECONDARY SCHOOL STUDENTS' CAREER CHOICES IN PENINSULAR MALAYSIA**

Dengan hormatnya surat daripada Kementerian Pendidikan Malaysia Bil. KPM.100-15/2/1/135 (50) bertarikh 17 Jun 2020 adalah dirujuk.

2. Sukacita dimaklumkan bahawa permohonan tuan untuk menjalankan kajian seperti tersebut di atas diluluskan dengan syarat:

2.1 Kelulusan ini bergantung kepada pertimbangan pentadbir sekolah.

2.2 Maklumat kajian dan pengkaji hendaklah dinyatakan dalam borang soal selidik.

2.3 Instrumen kajian disediakan dalam dwi bahasa (Bahasa Inggeris dan Bahasa Melayu).

3. Sehubungan itu, tuan boleh berhubung terus dengan Pegawai Pendidikan Daerah dan Pengetua sekolah-sekolah berkenaan untuk mendapatkan maklumat dan tindakan selanjutnya. Surat kelulusan ini sah digunakan bermula **01 Ogos 2020** hingga **31 Januari 2021**.

4. Sila bawa surat ini semasa membuat kajian dan tuan hendaklah kemukakan kepada jabatan ini senaskhah laporan akhir kajian dalam bentuk hardcopy bersama salinan softcopy berformat pdf dalam CD setelah selesai kelak.

Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA"

Saya yang menjalankan amanah,

(HASAN BIN ABD RASHID)
Penolong Pendaftar Institusi Pendidikan dan Guru,
Jabatan Pendidikan Negeri Johor
b.p. Ketua Pendaftar Institusi Pendidikan dan Guru,
Kementerian Pendidikan Malaysia.

sdj-kajian

KEMENTERIAN PENDIDIKAN MALAYSIA
Jabatan Pendidikan Negeri Perak
Jalan Tun Abdul Razak
30640 Ipoh, Perak Darul Ridzuan

Tel : 605 501 5000
Faks : 605 527 7273
Laman Web : http://jpnperak.moe.gov.my

"PENDIDIKAN BERKUALITI, SEKOLAH UNGGUL, MURID HOLISTIK"

Ruj. Kami : JPNPk.SPS.SMT6.600-1(37)
Tarikh : 7 Ogos 2020

Tiny Tey Chiu Yuen
Faculty Of Creative Industries
Universiti Tunku Abdul Rahman
Bandar Sungai Long
43200 Kajang
Selangor Darul Ehsan

Tuan,

KELULUSAN UNTUK MENJALANKAN KAJIAN DI SEKOLAH-SEKOLAH DI NEGERI PERAK DI BAWAH JABATAN PENDIDIKAN NEGERI PERAK

Sukacita perkara di atas dirujuk dan surat tuan yang diterima pada **28 Julai 2020** adalah berkaitan.

2. Sehubungan dengan itu, dimaklumkan bahawa Jabatan Pendidikan Negeri Perak **tiada halangan** untuk membenarkan pihak tuan menjalankan kajian yang bertajuk **'STEM: Antecedents Of Secondary School Students' Career Choices In Peninsular Malaysia'** seperti dinyatakan dalam surat tuan dengan syarat-syarat berikut :

2.1 Pihak tuan perlu mendapatkan kebenaran terlebih dahulu daripada Pegawai Pendidikan Daerah dan Pengetua sekolah berkenaan untuk menggunakan sampel kajian;

2.2 Kajian yang dijalankan hendaklah tidak mengganggu proses pengajaran dan pembelajaran yang telah ditetapkan oleh pihak sekolah;

2.3 Pihak tuan bertanggungjawab menjaga keselamatan dan kebajikan murid dan guru yang terlibat dalam kajian ini;

2.4 Murid, guru dan warga sekolah tidak boleh dipaksa terlibat dalam kajian ini;

2.5 Pihak tuan hendaklah bertanggungjawab menanggung semua kos kajian;

2.6 Pihak tuan dipohon agar menghantar satu (1) salinan laporan kajian dalam tempoh 30 hari ke jabatan ini selepas kajian tersebut dilaksanakan; dan

We Deliver

Sila catatkan rujukan Jabatan ini apabila berhubung

2.7 Tiada sebarang implikasi kewangan kepada Jabatan Pendidikan Negeri Perak, Pejabat Pendidikan Daerah dan pihak sekolah.

3. Sukacita juga diingatkan, sekiranya sebahagian atau sepenuhnya dapatan kajian tersebut hendak dibentangkan di mana-mana forum atau seminar atau diumumkan kepada media massa, pihak tuan perlu mendapatkan kebenaran terlebih dahulu daripada Bahagian Perancangan dan Penyelidikan Dasar Pendidikan, Kementerian Pendidikan Malaysia dan satu (1) salinan kepada Jabatan Pendidikan Negeri Perak.

4. Kebenaran ini adalah untuk tujuan yang dipohon dan melibatkan sekolah dalam daerah yang dinyatakan sahaja dan luput **selepas tarikh 31 Januari 2021**

Sekian terima kasih.

"BERKHIDMAT UNTUK NEGARA"

Saya yang menjalankan amanah,

(AZMI BIN DAHALI)
Timbalan Pengarah Pendidikan
Sektor Pengurusan Sekolah
b.p Pengarah Pendidikan Negeri Perak

s.k. 1. Pengarah Pendidikan Negeri Perak

KEMENTERIAN PENDIDIKAN MALAYSIA
Jabatan Pendidikan Negeri Pulau Pinang
Jalan Bukit Gambir
11700 Pulau Pinang

Tel. : 04-657 5500
Faks : 04-658 2500
Laman Web : http://www.jpnpenang.edu.my

Ruj. Kami: JPNPP(MEN) 100-3 Jld.3 (23)
Tarikh: 11 Ogos 2020

Tiny Tey Chiu Yuen
Faculty of Creative Industries
Universiti Tunku Abdul Rahman
Bandar Sungai Long
43200 Kajang
Selangor

Tuan,

PERMOHONAN MENJALANKAN KAJIAN DI SEKOLAH-SEKOLAH MENENGAH

Dengan segala hormatnya saya merujuk surat tuan yang diterima pada tarikh 05 Ogos 2020 mengenai perkara di atas.

2. Surat **Kelulusan Bersyarat Untuk Menjalankan Kajian:** ***"STEM: Antecedents of Secondary School Students' Career Choices in Peninsular Malaysia".*** daripada Bahagian Perancangan Dan Penyelidikan Dasar Pendidikan, Kementerian Pendidikan Malaysia, No. Ruj.: KPM.100-15/2/135(50) bertarikh 17 Jun 2020 adalah **dirujuk**.

3. Sukacita dimaklumkan bahawa Pihak Jabatan Pendidikan Negeri Pulau Pinang **tiada halangan** untuk pihak tuan menghubungi sekolah mengenai kajian seperti di atas. Surat kebenaran ini **harus dibaca bersama** surat daripada Bahagian Perancangan Dan Penyelidikan Dasar Pendidikan, KPM seperti di atas. Pihak tuan dibenarkan berurusan dengan **Pengetua / Guru Besar** sekolah berkenaan untuk mengadakan perbincangan dan edaran maklumat bagi tujuan perkara di atas.

4. Walau bagaimanapun pihak tuan juga adalah tertakluk kepada syarat-syarat seperti berikut:

4.1 Mendapat kebenaran dari Pengetua / Guru Besar sekolah berkenaan.
4.2 Tidak mengganggu perjalanan pengajaran dan pembelajaran, peraturan dan disiplin sekolah.
4.3 Segala maklumat yang dikumpul adalah untuk tujuan akademik sahaja.
4.4 Sekiranya laporan diterbitkan atau disiarkan dalam mana-mana platform media, bahan tersebut perlu mendapat persetujuan terlebih dahulu daripada pihak kementerian
4.5 Penyertaan guru adalah secara sukarela, tanpa sebarang unsur paksaan.

Appendix B4: Sample Request Letter for Schools

Tarikh: 28 Julai 2020

Pengarah
Jabatan Pendidikan Negeri Selangor,
Jalan Jambu Bol 4/3E,
Seksyen 4,
40604 Shah Alam,
Selangor Darul Ehsan.

PERMOHONAN MENJALANKAN KAJIAN DI SEKOLAH-SEKOLAH MENENGAH

Perkara di atas adalah dirujuk.

Dengan hormatnya dimaklumkan bahawa kami ingin memohon kebenaran tuan/puan untuk menjalankan kajian bertajuk "*STEM: Antecedents of Secondary School Students' Career Choices in Peninsular Malaysia*". Surat permohonan ini dilampirkan dengan kertas cadangan penyelidikan di Lampiran A untuk rujukan tuan/puan.

Kelulusan dari pihak Kementerian Pendidikan Malaysia (Nombor rujukan: KPM.100-15/2/135(50)) telah kami perolehi dan surat tersebut dilampirkan bersama permohonan ini (Lampiran B).

Kajian ini dirancang untuk dijalankan di sekolah-sekolah menengah yang disenaraikan di Lampiran C. Data akan dikumpul menggunakan borang soal selidik dari 1 Ogos 2020 hingga 31 Januari 2021.

Kami berharap pihak tuan/puan dapat memberi kelulusan yang diperlukan untuk menjalankan kajian di sekolah-sekolah menengah tersebut.

Jasa baik tuan/puan didahulukan dengan ucapan jutaan terima kasih. Sekian.

Yang benar,

Tiny Tey Chiu Yuen
Penyelidik Doktor Falsafah
Faculty of Creative Industries
Universiti Tunku Abdul Rahman (UTAR)
Sungai Long Campus, Jalan Sungai Long,
Bandar Sungai Long, Cheras, 43000 Kajang,
Selangor.
E-mail: ttcyuen456@gmail.com
HP: [redacted]2

Diakui oleh,

Priscilla
Priscilla (Jul 29, 2020 11:49 GMT+8)

Assistant Professor Dr Priscilla Moses
Penyelia
Faculty of Creative Industries
Universiti Tunku Abdul Rahman (UTAR)
Sungai Long Campus, Jalan Sungai Long,
Bandar Sungai Long, Cheras, 43000 Kajang,
Selangor.
E-mail: priscilla@utar.edu.my

APPENDIX C

RESEARCH INSTRUMENT

Appendix C1: Questionnaire in English

STEM: ANTECEDENTS OF SECONDARY SCHOOL STUDENTS' CAREER CHOICES IN PENINSULAR MALAYSIA

* Required

CONSENT FORM

1. Read the information below.
2. Tick the statements at the bottom of this page if you agree to join this survey.
3. Survey will start on Page 3 and end on Page 4.

A. PURPOSE OF THE STUDY

You are invited to participate in this research. The purpose of this research is to explore the factors that influence Malaysian school students' career choices in Science, Technology, Engineering and Mathematics (STEM). Before you decide to participate in this study, it is important that you understand why the research is being done and what it will involve. Please read the following information carefully. Please ask the researcher if there is anything that is not clear or if you need more information.

B. BENEFITS

This research would create your awareness towards the STEM fields and career outlook. Besides, the information obtained through your involvement from this study may contribute to the body of knowledge of students' career choices in STEM in Peninsular Malaysia.

C. STUDY PROCEDURES

This study is conducted in secondary schools in Peninsular Malaysia. The procedures of conducting the survey are listed as below:

- All participants of this research must be Form 4 students.
- The purpose of the study will be explained to the participants.
- Consent from the participants and their parent/ guardian should be given before joining this survey.
- The participants may contact the researcher when further clarification or information is needed.
- The survey would take about 15 minutes.
- The participants should try to answer all items in the questionnaire.

D. CONFIDENTIALITY

All information that you provide will be kept confidential by the researchers, and will not be made available to the public unless disclosure is required by the law. Data obtained from this research will not identify you individually. Your responses to this survey will be anonymous. Each questionnaire will be assigned code names to ensure information of the participants are not revealed. The original records will be reviewed by the principal investigator and the research team, the university, the sponsor and regulatory authorities for the purpose of verifying research procedures and/or data.

E. STATEMENT OF THE RESEARCHER

I, the researcher, have fully explained to the participant taking part in this study what he/she can expect by virtue of his/her participation. The participant who gives consent to take part in this study understands the language that I have used, reads well enough to understand this form, or is able to hear and understand the contents of the form when read to him or her. To the best of my knowledge, when the participant signs this form, he/she understands (i) that taking part in the study is voluntary, (ii) what the study is about, (iii) what needs to be done, and (iv) what the potential benefits are. If you have questions at any time about this study, you may contact the researcher Ms Tiny Tey Chiu Yuen (ttcyuen456@gmail.com).

F. VOLUNTARY PARTICIPATION

Participation in this study is voluntary and if you decide not to participate, you will experience no penalty or loss of benefits. If you decide to participate, you may subsequently change your mind about being in this study, and may stop participating at any time. By signing this consent form, you authorise the record review, publication and reutilisation of data and information as described above.

G. PARENTAL / GUARDIAN CONSENT

I, the researcher, am pleased to inform you that your child is chosen to participate in this research titled "STEM: Antecedents of Secondary School Students' Career Choices in Peninsular Malaysia". Therefore, I would like to kindly seek your consent to carry out the survey questionnaire with your child. Participation in this study is voluntary. There will be no penalty or loss of benefits if your child do not participate. By giving consent to your child's participation in this research, you would contribute to the research and help to create awareness towards the STEM fields and career outlook. By signing this form, you voluntarily agree your child to participate in this research.

1. By ticking the statement below, you voluntarily agree your child to participate in this research. *

   Check all that apply.

   ☐ Yes, I agree.

H. PARTICIPANT (STUDENT) CONSENT

I, a Form 4 student, have read, or have had read to me, all pages of this consent form in the language understandable to me. The above content has been fully explained to me. I have asked all questions that I need to know about this study. All my questions have been answered. I voluntarily consent and offer to take part in this study. By signing this consent form, I certify that all information I have given is true and correct to the best of my knowledge. I will not hold the research team responsible for any consequences and/or liability whatsoever arising from my participation in this study.

2. By ticking the statement below, you voluntarily agree to participate in this research. *

   Check all that apply.

   ☐ Yes, I agree.

PERSONAL DATA PROTECTION STATEMENT	Please be informed that in accordance with Personal Data Protection Act 2010 ("PDPA") which came into force on 15 November 2013, Universiti Tunku Abdul Rahman ("UTAR") is hereby bound to make notice and require consent in relation to collection, recording, storage, usage and retention of personal information.

Notice

1. The purposes for which your personal data may be used are inclusive but not limited to:-
- For assessment of any application to UTAR
- For processing any benefits and services
- For communication purposes
- For advertorial and news
- For general administration and record purposes
- For enhancing the value of education
- For educational and related purposes consequential to UTAR
- For the purpose of our corporate governance
- For consideration as a guarantor for UTAR staff/ student applying for his/her scholarship/ study loan

2. Your personal data may be transferred and/or disclosed to third party and/or UTAR collaborative partners including but not limited to the respective and appointed outsourcing agents for purpose of fulfilling our obligations to you in respect of the purposes and all such other purposes that are related to the purposes and also in providing integrated services, maintaining and storing records. Your data may be shared when required by laws and when disclosure is necessary to comply with applicable laws.

3. Any personal information retained by UTAR shall be destroyed and/or deleted in accordance with our retention policy applicable for us in the event such information is no longer required.

4. UTAR is committed in ensuring the confidentiality, protection, security and accuracy of your personal information made available to us and it has been our ongoing strict policy to ensure that your personal information is accurate, complete, not misleading and updated. UTAR would also ensure that your personal data shall not be used for political and commercial purposes.

Consent

1. By submitting this form, you hereby authorise and consent to us processing (including disclosing) your personal data and any updates of your information, for the purposes and/or for any other purposes related to the purpose.

2. If you do not consent or subsequently withdraw your consent to the processing and disclosure of your personal data, UTAR will not be able to fulfill our obligations or to contact you or to assist you in respect of the purposes and/or for any other purposes related to the purpose.

3. You may access and update your personal data by writing to us at ttcyuen456@gmail.com (Ms Tiny Tey).

3. Acknowledgment of Notice *

Check all that apply.

☐ I have been notified and hereby understood, consented and agreed per UTAR above notice.

PART A: Demographic Information	This section aims to collect some background information about yourself. Please answer every item in this section.

1. Gender

Mark only one oval.

- Female
- Male

2. Your birthday

Example: January 7, 2019

3. Stream of Study (Choose only one option based on the subjects that you have registered: STEM or Non-STEM) *

Mark only one oval.

- STEM (Science Stream): Physics (Fizik), Chemistry (Kimia), Biology (Biologi), Additional Mathematics (Matematik Tambahan), Additional Science (Sains Tambahan), Technical Graphic Communication (Grafik Komunikasi Teknikal), Basics of Sustainability (Asas Kelestarian), Home Science (Sains Rumah Tangga) , Agriculture (Pertanian), Invention (Reka Cipta), Computer Science (Sains Komputer), Sport Science (Sains Sukan).
- NON-STEM (Arts Stream): Geography (Geografi), Economics (Ekonomi), Commerce (Perniagaan), Visual Arts Education (Pendidikan Seni Visual), Music Education (Pendidikan Muzik), Malay Literature (Kesusasteraan Melayu), Literature in English (Kesusateraan Inggeris), Chinese Literature (Kesusateraan Cina), Tamil Literature (Kesusasteraan Tamil), etc.

4. Name of Your School *

5. State of Your School *

Mark only one oval.

- Perak
- Johor
- Negeri Sembilan
- Selangor
- Kedah
- Pulau Pinang
- Pahang
- Melaka
- Wilayah Persekutuan Putrajaya
- Kelantan
- Perlis
- Terengganu
- Wilayah Persekutuan Kuala Lumpur

PART B

SECTION 1: Attitude towards STEM as A Career

This section is to survey your attitude towards career choice. Please respond to every item in this section.

ACC1: A career in STEM is good. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree						Strongly Agree

ACC2: A career in STEM will make me feel good. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

ACC3: A career in STEM will make me happy. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

ACC4: A career in STEM is meaningful to me. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

ACC5: A career in STEM will bring me respect. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

ACC6: A career in STEM makes me feel proud. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

Section 2: Perceived Behavioural Control

This section is to survey your confidence, ability and control over the career that you would like to choose in future. Please respond to every item in this section.

PBC1: I am confident I will be able to choose a career in STEM. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

PBC2: I think it is easy for me to choose a career in STEM. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

PBC3: I expect myself to have the ability to choose a career in STEM. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

PBC4: I have good ability to choose a career in STEM. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	⬭	⬭	⬭	⬭	⬭	Strongly Agree

PBC5: I have the self-confidence to choose a career in STEM. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	⬭	⬭	⬭	⬭	⬭	Strongly Agree

PBC6: It is under my control to choose a career in STEM. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	⬭	⬭	⬭	⬭	⬭	Strongly Agree

Section 3: Subjective Norm (Teachers)

This section is to review your opinion towards the important roles of teachers towards your career selection. Please respond to every item in this section.

SN1: My teachers think that I should choose a career in STEM. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	⬭	⬭	⬭	⬭	⬭	Strongly Agree

SN2: My teachers think that I should choose a career in STEM, therefore I should do so. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

SN3: My teachers' advice is important to my career choice in STEM. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

SN4: My teachers' teaching will encourage me to choose a career in STEM. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

SN5: My teachers' teaching increase my interest to choose a career in STEM. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

Section 3: Subjective Norm (Parents)

This section is to review your opinion towards the important roles of parents towards your career selection. Please respond to every item in this section.

SN6: My parents think that I should choose a career in STEM. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

SN7: My parents think that I should choose a career in STEM, therefore I should do so. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

SN8: My parents' advice is important to my career choice in STEM. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

SN9: My parents encourage me to choose a career in STEM. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

SN10: My parents' encouragement will increase my interest to choose a career in STEM. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

Section 3: Subjective Norm (Friends)

This section is to review your opinion towards the important roles of friends towards your career selection. Please respond to every item in this section.

SN11: My friends think that I should choose a career in STEM. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

SN12: My friends think that I should choose a career in STEM, therefore I should do so. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

SN13: My friends' advice is important to my career choice in STEM. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

SN14: My friends encourage me to choose a career in STEM. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

SN15: My friends' encouragement will increase my interest to choose a career in STEM. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

Section 4: Financial Rewards

This section is to survey your opinion on financial rewards when choosing a career. Please respond to every item in this section.

FR1: A career in STEM pays well. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	⬭	⬭	⬭	⬭	⬭	Strongly Agree

FR2: A career in STEM will give me good long-term earnings. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	⬭	⬭	⬭	⬭	⬭	Strongly Agree

FR3: A career in STEM will give me good starting salary. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

FR4: A career in STEM will give me stable income. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

FR5: A career in STEM will provide me good living standard. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

FR6: A career in STEM will give me a financially secured future. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

FR7: A career in STEM allows me to make a lot of money. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

FR8: A career in STEM pays better than other careers. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

Section 5: Media Exposure

This section is to survey your exposure to media. Please respond to every item in this section.

ME1: I spend time watching television/online television channels (e.g.: Movie, television programme, drama, etc.). *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

ME2: I spend time reading newspaper/online newspaper/e-newspaper(s). *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

ME3: I spend time reading book/online book/ e-book(s). *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

ME4: I spend time surfing the internet. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

ME5: I spend time scrolling through social media on the internet (e.g.: Facebook, Twitter, Instagram, etc.). *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

ME6: I spend time on social networking services (e.g.: Whatsapp, WeChat, LINE, etc.). *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

ME7: I spend time on YouTube. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

ME8: I spend time on online/offline promotional materials (e.g.: Poster, billboard, advertisement, flyer, etc.). *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

Section 6: Career Interest

This section is to survey your career interest. Please respond to every item in this section.

Examples of STEM careers:
Doctor, Engineer, Scientist, Biologist, Chemists, Physicists, Software Developer, Web and Multimedia Developer, Database Designer, Electrical Engineers, Civil Engineer, Telecommunications Engineer, Mathematician, Actuary, Statistician, etc.

CI1: I will choose a career that I find interesting. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

CI2: I will choose a career that I like. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	⬭	⬭	⬭	⬭	⬭	Strongly Agree

CI3: I will choose a career that allows me to learn new things each day. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	⬭	⬭	⬭	⬭	⬭	Strongly Agree

CI4: I will choose a career that is challenging for me. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	⬭	⬭	⬭	⬭	⬭	Strongly Agree

CI5: I will choose a career that is related to the subjects that I like in school. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	⬭	⬭	⬭	⬭	⬭	Strongly Agree

CI6: I will choose a career that is related to the subjects I do well in exams. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	⬭	⬭	⬭	⬭	⬭	Strongly Agree

CI7: I will choose a career that is related to the activities I like in school. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	⬭	⬭	⬭	⬭	⬭	Strongly Agree

CI8: I will choose a career that will provide me the opportunities to meet new people. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	⬭	⬭	⬭	⬭	⬭	Strongly Agree

Section 7: Career Choice Intention

This section is to survey your intention in choosing a career in future. Please respond to every item in this section.

CCI1: I will choose a career in STEM. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	⬭	⬭	⬭	⬭	⬭	Strongly Agree

CCI2: I intend to choose a career in STEM. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

CCI3: I aim to choose a career in STEM. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

CCI4: I plan to choose a career in STEM. *

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

THANK YOU VERY MUCH FOR TAKING THE TIME TO COMPLETE THE SURVEY!
—This is the end of the survey—

Appendix C2: Questionnaire in Malay

STEM: FAKTOR-FAKTOR PEMILIHAN KERJAYA PELAJAR-PELAJAR SEKOLAH MENENGAH DI SEMENANJUNG MALAYSIA

* Required

BORANG PERSETUJUAN

1. Sila baca maklumat di bawah.
2. Sila tanda pada perakuan di hujung bawah mukasurat ini sekiranya anda bersetuju untuk menyertai tinjauan ini.
3. Tinjauan akan bermula pada mukasurat 3 dan tamat pada mukasurat 4.

A. TUJUAN KAJIAN

Anda dijemput untuk mengambil bahagian dalam kajian ini. Tujuan kajian ini adalah untuk meninjau faktor yang mempengaruhi pilihan kerjaya pelajar dalam sains, teknologi, kejuruteraan dan matemarik (STEM) di Malaysia. Sebelum anda memilih untuk mengambil bahagian dalam kajian ini, penting buat anda untuk memahami asbab disebalik kajian dan perkara-perkara yang terlibat. Sila baca maklumat berikut dengan teliti. Sebarang perkara yang tidak jelas atau memerlukan lebih penerangan sila bertanya kepada penyelidik.

B. KEPENTINGAN KAJIAN

Kajian ini dapat memupuk kesedaran anda terhadap bidang dan perspektif kerjaya dalam STEM. Selain itu, maklumat yang diperoleh daripada penglibatan anda dalam kajian ini akan menyumbang kepada pengetahuan secara menyeluruh tentang pemilihan kerjaya pelajar dalam STEM di Semenanjung Malaysia.

C. PROSEDUR KAJIAN

Kajian ini dijalankan di sekolah menengah di Semenanjung Malaysia. Prosedur pelaksanaan tinjauan ini adalah seperti di bawah:

- Setiap peserta kajian ini mestilah pelajar Tingkatan 4.
- Tujuan kajian akan diterangkan kepada peserta.
- Persetujuan oleh peserta dan ibubapa/penjaga perlu diberikan sebelum menyertai kajian ini.
- Peserta dibenarkan untuk menghubungi penyelidik apabila memerlukan maklumat dan penjelasan yang lebih mendalam.
- Tinjauan ini akan mengambil masa lebih kurang 15 minit.
- Sebaik-baiknya peserta digalakkan menjawab kesemua item dalam borang soal selidik.

D. KERAHSIAAN

Segala maklumat yang diberikan akan dirahsiakan oleh penyelidik dan tidak akan boleh diakses oleh orang awam kecuali melalui desakan undang-undang. Data yang diperoleh daripada kajian ini tidak mengenalpasti anda secara individu. Respon yang anda berikan adalah tanpa nama. Setiap borang kaji selidik akan diberikan kod untuk memastikan maklumat peserta tidak terdedah. Rekod asal akan dikaji oleh penyelidik, pihak universiti, pihak penaja dan penguatkuasa kawal selia bagi tujuan pengesahan prosedur kajian dan/atau data.

E. PERAKUAN PENYELIDIK

Saya, penyelidik, telah menerangkan dengan jelas kepada peserta tentang apa yang perlu dijangka daripada menyertai kajian ini.. Peserta yang telah bersetuju memahami bahasa yang digunakan, mampu membaca dan memahami borang ini, atau mampu mendengar dan memahami kandungan borang ini apabila dibacakan. Melalui pengetahuan dan pemahaman saya, apabila peserta menandatangani borang ini, dia memahami (i) bahawa dia mengambil bahagian dalam kajian ini secara suka rela, (ii) mengetahui perihal tentang kajian ini, (iii) apa yang perlu dilakukan, dan (iv) kelebihan yang mungkin diperoleh. Sekiranya anda mempunyai sebarang persoalan tentang kajian ini, sila hubungi penyelidik Cik Tiny Tey Chiu Yuen (ttcyuen456@gmail.com).

F. PENYERTAAN SECARA SUKA RELA

Penyertaan dalam kajian ini berasaskan suka rela dan tiada penalti atau kerugian sekiranya anda memilih untuk tidak menyertai kajian ini. Seandainya anda bersetuju untuk mengambil bahagian tetapi berubah fikiran semasa kajian berlangsung, anda dibenarkan untuk berhenti pada bila-bila masa. Dengan menandatangani borang persetujuan ini, anda memberi kebenaran untuk data dan maklumat dikaji semula, diterbitkan dan digunakan semula seperti yang disebut di atas.

G. PERSETUJUAN IBUBAPA / PENJAGA

Saya, penyelidik, dengan berbesar hati memaklumkan bahawa anak anda terpilih untuk mengambil bahagian dalam kajian yang bertajuk, STEM: Faktor-faktor Pemilihan Kerjaya Pelajar-pelajar Sekolah Menengah di Semenanjung Malaysia". Sehubungan dengan itu, pihak kami ingin mendapatkan persetujuan anda untuk membenarkan anak anda menjawab borang soal selidik kajian ini. Penyertaan dalam kajian ini adalah secara suka rela. Tiada penalti atau kerugian sekiranya anak anda memilih untuk tidak menyertai kajian ini. Walau bagaimanapun, dengan persetujuan untuk membenarkan anak anda mengambil bahagian, anda telah membantu kajian ini dan meyumbang kepada usaha memupuk kesedaran terhadap bidang dan persektif kerjaya dalam STEM. Dengan menandatangani borang ini, anda secara suka rela memberi persetujuan untuk anak anda menyertai kajian ini.

1. Dengan menanda penyataan di bawah, anda dengan suka rela bersetuju untuk anak anda mengambil bahagian dalam kajian ini. *

   Check all that apply.

   - [ ] Ya, saya setuju.

H. PERSETUJUAN PESERTA (PELAJAR)

Saya, pelajar Tingkatan 4, telah membaca atau dibacakan, kesemua mukasurat borang persetujuan ini dalam bahasa yang saya fahami. Kandungan di atas telah diterangkan sepenuhnya kepada saya. Saya juga telah bertanya semua perkara yang saya perlu tahu tentang kajian ini dan semua soalan saya telah dijawab. Saya dengan suka rela bersetuju dan mahu mengambil bahagian dalam kajian ini. Dengan menandatangani borang persetujuan ini, saya mengakui semua maklumat yang diberikan adalah benar dan tepat mengikut pengetahuan saya. Pihak penyelidik tidak akan dipertanggungjawabkan atas sebarang kesan dan/atau liabiliti yang terhasil daripada penyertaan saya dalam kajian ini.

2. Dengan menanda penyataan di bawah, anda bersetuju untuk mengambil bahagian dalam kajian ini secara sukarela. *

Check all that apply.

☐ Ya, saya setuju.

PERAKUAN PERLINDUNGAN DATA PERIBADI	Akta Perlindungan Data Peribadi 2010 ("PDPA") yang berkuatkuasa bermula 15 November 2013, mengkehendaki Universiti Tunku Abdul Rahman ("UTAR") untuk membuat pemberitahuan dan mendapatkan persetujuan bagi mengumpul, merakam, menyimpan, mengguna, dan mengekalkan maklumat peribadi anda.

Notis

1. Tujuan penggunaan data peribadi anda termasuk tapi tidak terbatas pada:-

- Untuk penilaian mana-mana permohonan kepada UTAR
- Untuk pemprosesan mana-mana faedah dan perkhidmatan
- Untuk tujuan perhubungan
- Untuk rencana iklan (advertorial) dan berita
- Untuk tujuan rekod dan pengurusan am
- Untuk menambahbaik nilai pendidikan
- Untuk tujuan pendidikan dan yang berkaitan dengannya yang berkepentingan kepada UTAR
- Untuk tujuan pentadbiran korporat UTAR
- Untuk dipertimbangkan sebagai penjamin untuk staf/pelajar UTAR yang memohon pinjaman pendidikan sendiri

2. Data peribadi anda mungkin dipindah dan/atau didedahkan kepada pihak ketiga dan/atau rakan kongsi UTAR termasuk tapi tidak terbatas kepada ejen penyumberluaran (oursourcing) yang dilantik dengan tujuan memastikan tanggungjawab kepada anda dipenuhi berdasarkan tujuan-tujuan yang dinyatakan dan tujuan-tujuan lain yang berkaitan dengan tujuan tersebut, selain untuk memberikan perkhidmatan bersepadu, menyelenggara dan menyimpan rekod. Data anda mungkin akan dikongsi sekiranya ada desakan undang-undang yang memerlukan pendedahan bagi mematuhi undang-undang yang terlibat.
3. Sebarang maklumat peribadi yang disimpan oleh UTAR akan dimusnahkan dan/atau dilupuskan sekiranya tidak diperlukan berdasarkan polisi yang berkaitan.
4. UTAR komited dalam memastikan kerahsiaan, perlindungan, keselamatan dan ketepatan maklumat peribadi anda yang diterima dan mengamalkan polisi yang tegas dalam memastikan data peribadi anda tepat, menyeluruh, terkini dan tidak salah. UTAR juga memastikan maklumat peribadi anda tidak digunakan untuk tujuan politik dan komersial.

Persetujuan

1. Dengan penyerahan borang ini, anda dengan ini memberi kebenaran dan persetujuan untuk pemprosesan (termasuk pendedahan) data peribadi anda dan sebarang kemaskini maklumat anda, bagi tujuan yang dinyatakan dan tujuan-tujuan lain yang berkaitan dengan tujuan tersebut.
2. Sekiranya anda tidak bersetuju dengan pemprosesan dan pendedahan data peribadi anda atau menarik semula persetujuan anda selepas persetujuan dibuat, UTAR tidak bertanggungjawab untuk menghubungi atau membantu anda berdasarkan tujuan yang dinyatakan dan tujuan-tujuan lain yang berkaitan dengan tujuan tersebut.
3. Anda boleh mengakses dan mengemaskini data peribadi anda melalui email di ttcyuen456@gmail.com (Ms Tiny Tey).

3. Penyataan Pengakuan *

Check all that apply.

☐ Saya telah dimaklumkan dan dengan ini memahami, memberi kebenaran dan bersetuju dengan notis di atas.

BAHAGIAN A: Maklumat Demografi	Bahagian ini bertujuan untuk mengumpuL maklumat latar belakang diri anda. Sila jawab kesemua item dalam bahagian ini.

1. Jantina *

Mark only one oval.

- ( ) Perempuan
- ( ) Lelaki

2. Tarikh Lahir *

____

Example: January 7, 2019

3. Aliran Pengajian (Tandakan satu pilihan sahaja berdasarkan subjek yang telah anda daftarkan: STEM atau Bukan STEM) *

Mark only one oval.

- ( ) STEM (Aliran Sains): Physics (Fizik), Chemistry (Kimia), Biology (Biologi), Additional Mathematics (Matematik Tambahan), Additional Science (Sains Tambahan), Technical Graphic Communication (Grafik Komunikasi Teknikal), Basics of Sustainability (Asas Kelestarian), Home Science (Sains Rumah Tangga) , Agriculture (Pertanian), Invention (Reka Cipta), Computer Science (Sains Komputer), Sport Science (Sains Sukan).
- ( ) NON-STEM (Aliran Sastera): Geography (Geografi), Economics (Ekonomi), Commerce (Perniagaan), Visual Arts Education (Pendidikan Seni Visual), Music Education (Pendidikan Muzik), Malay Literature (Kesusasteraan Melayu), Literature in English (Kesusateraan Inggeris), Chinese Literature (Kesusateraan Cina), Tamil Literature (Kesusasteraan Tamil), etc.

4. Nama sekolah *

5. Negeri sekolah anda *

Mark only one oval.

- Perak
- Johor
- Negeri Sembilan
- Selangor
- Kedah
- Pulau Pinang
- Pahang
- Melaka
- Wilayah Persekutuan Putrajaya
- Kelantan
- Perlis
- Terengganu
- Wilayah Persekutuan Kuala Lumpur

BAHAGIAN B

SEKSYEN1: Sikap Terhadap STEM Sebagai Satu Kerjaya
Seksyen ini adalah untuk meninjau sikap anda terhadap pilihan kerjaya. Sila beri respon kepada setiap item dalam seksyen ini.

ACC1: Kerjaya dalam STEM adalah baik. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju						Sangat Setuju

ACC2: Kerjaya dalam STEM akan membuat saya rasa selesa. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

ACC3: Kerjaya dalam STEM akan membuat saya rasa gembira. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

ACC4: Kerjaya dalam STEM memberi makna kepada saya. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

ACC5: Kerjaya dalam STEM akan menjadikan diri saya dihormati. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

ACC6: Kerjaya dalam STEM membanggakan diri saya. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

SEKSYEN 2: Kesedaran Kawalan Tingkahlaku

Seksyen ini meninjau keyakinan, kebolehan dan kawalan ke atas kerjaya yang hendak anda pilih pada masa hadapan. Sila beri respon kepada setiap item dalam syeksen ini.

PBC1: Saya yakin saya boleh memilih kerjaya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

PBC2: Saya berpendapat bahawa adalah mudah saya memilih kerjaya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

PBC3: Saya menjangkakan bahawa saya mempunyai kemampuan memilih kerjaya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

PBC4: Saya berkebolehan untuk memilih kerjaya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

PBC5: Saya mempunyai keyakinan diri untuk memilih kerjaya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

PBC6: Ia adalah di bawah kawalan saya untuk memilih kerjaya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

SEKSYEN3: Norma Subjektif (Guru-guru)

Seksyen ini adalah untuk meninjau pandangan anda terhadap peranan guru-guru terhadap pilihan kerjaya yang anda kehendaki. Sila beri respon kepada setiap item dalam seksyen ini.

SN1: Guru saya berpandangan bahawa saya patut memilih kerjaya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

SN2: Guru saya berpandangan bahawa saya patut memilih kerjaya di dalam STEM, jadi saya patut berbuat demikian. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

SN3: Nasihat guru saya penting dalam pemilihan kerjaya saya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

SN4: Pengajaran guru saya akan menggalakkan saya memilih kerjaya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

SN5: Pengajaran guru saya meningkatkan minat saya untuk memilih kerjaya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

SEKSYEN3: Norma Subjektif (Ibu bapa)

Seksyen ini adalah untuk meninjau pandangan anda terhadap peranan ibu bapa terhadap pilihan kerjaya yang anda kehendaki. Sila beri respon kepada setiap item dalam seksyen ini.

SN6: Ibu bapa saya berpendapat bahawa saya patut memilih kerjaya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

SN7: Ibu bapa saya berpendapat bahawa saya patut memilih kerjaya dalam STEM, jadi saya patut berbuat demikian. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

SN8: Nasihat ibu bapa saya penting dalam pemilihan kerjaya saya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

SN9: Ibu bapa saya menggalakkan saya memilih kerjaya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

SN10: Galakkan ibu bapa saya akan meningkatkan minat saya untuk memilih kerjaya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

SEKSYEN3: Norma Subjektif (Rakan-rakan)

Seksyen ini adalah untuk meninjau pandangan anda terhadap peranan rakan-rakan terhadap pilihan kerjaya yang anda kehendaki. Sila beri respon kepada setiap item dalam seksyen ini.

SN13: Nasihat rakan-rakan saya penting dalam memilih kerjaya saya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

SN14: Rakan-rakan saya menggalakkan saya memilih kerjaya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

SN15: Galakkan rakan-rakan saya akan meningkatkan minat saya dalam memilih kerjaya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

SN11: Rakan-rakan saya berpendapat bahawa saya patut memilih kerjaya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

SN12: Rakan-rakan saya berpendapat bahawa saya patut memilih kerjaya dalam STEM, jadi saya patut berbuat demikian. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

SN13: Nasihat rakan-rakan saya penting dalam memilih kerjaya saya dalam STEM.
*

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

SN14: Rakan-rakan saya menggalakkan saya memilih kerjaya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

SN15: Galakkan rakan-rakan saya akan meningkatkan minat saya dalam memilih kerjaya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

SEKSYEN 4: Ganjaran Kewangan

Seksyen ini adalah untuk meninjau pandangan anda tentang gaji yang akan diterima sekiranya memilih seuatu kerjaya. Sila beri respon kepada setiap item dalam seksyen ini.

FR1: Kerjaya dalam STEM menawarkan gaji yang baik. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

FR2: Kerjaya dalam STEM akan memberi pulangan jangka panjang yang baik. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

FR3: Kerjaya dalam STEM akan menawarkan gaji permulaan yang baik. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

FR4: Kerjaya dalam STEM akan menjamin pendapatan yang stabil. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

FR5: Kerjaya dalam STEM akan memberikan saya taraf hidup yang baik. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

FR6: Kerjaya dalam STEM memberikan saya jaminan kewangan yang baik pada masa hadapan. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

FR7: Kerjaya dalam STEM membolehkan saya menjana pendapatan yang banyak. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

FR8: Kerjaya dalam STEM menawarkan gaji lebih tinggi berbanding kerjaya lain. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

SEKSYEN5: Pendedahan Kepada Media

Seksyen ini meninjau pendedahan anda kepada media.Sila beri respon kepada setiap item dalam seksyen ini.

ME1: Saya meluangkan masa untuk menonton televisyen/ rangkaian televisyen atas talian (cth.: Movie, program televisyen, drama, dll.). *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

ME2: Saya meluangkan masa untuk membaca suratkhabar/akhbar dalam talian/e-suratkhabar. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

ME3: Saya meluangkan masa untuk membaca buku/ buku atas talian/ e-buku. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

ME4: Saya meluangkan masa untuk melayari internet. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

ME5: Saya meluangkan masa untuk melayari media sosial di internet. (cth.: Facebook, Twitter, Instagram, dll.). *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

ME6: Saya meluangkan masa di laman rangkaian sosial (cth.: Whatsapp, WeChat, LINE, dll.). *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

ME7: Saya meluangkan masa untuk YouTube. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

ME8: Saya meluangkan masa untuk bahan-bahan promosi atas talian/tanpa atas talian (sk.: Poster, billboard, pengiklanan, risalah, dll.). *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

SEKSYEN6: Minat Terhadap Kerjaya

Seksyen ini adalah untuk meninjau minat anda terhadap kerjaya yang diminati. Sila beri respon kepada setiap item dalam seksyen ini.

Contoh-contoh kerjaya dalam STEM:
Doktor, Jurutera, Saintis, Ahli Biologi, Ahli Kimia, Ahli Fizik, Pembangun Perisian Komputer, Web dan Pembangun Multimedia , Pereka Pangkalan Data, Jurutera Elektrik, Jurutera Awam, Jurutera Telekomunikasi , Ahli Matematik, Aktuari, Ahli Statistik, dll.

CI1: Saya akan memilih kerjaya yang saya rasa menarik. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

CI2: Saya akan memilih kerjaya yang saya suka. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

CI3: Saya akan memilih kerjaya yang akan membolehkan saya belajar perkara-perkara baharu setiap hari. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

CI4: Saya akan memilih kerjaya yang mencabar bagi saya. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	⬭	⬭	⬭	⬭	⬭	Sangat Setuju

CI5: Saya akan memilih kerjaya yang berkaitan dengan subjek yang saya suka di sekolah. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

CI6: Saya akan memilih kerjaya yang berkaitan dengan subjek yang saya dapat keputusan baik dalam peperiksaan. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

CI7: Saya akan memilih kerjaya yang berkaitan dengan aktiviti-aktiviti yang saya suka di sekolah. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

CI8: Saya akan memilih kerjaya yang akan memberikan saya peluang untuk bertemu orang baharu. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

SEKSYEN7: Keinginan Memilih Kerjaya

Seksyen ini adalah untuk meninjau keinginan memilih kerjaya anda pada masa hadapan. Sila beri respon kepada setiap item dalam seksyen ini.

CCI1: Saya akan memilih kerjaya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

CCI2: Saya bercadang untuk memilih kerjaya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

CCI3: Saya berhasrat untuk memilih kerjaya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

CCI4: Saya merancang untuk memilih kerjaya dalam STEM. *

Mark only one oval.

	1	2	3	4	5	
Sangat Tidak Setuju	◯	◯	◯	◯	◯	Sangat Setuju

TERIMA KASIH KERANA SUDI MELUANGKAN MASA UNTUK MELENGKAPKAN BORANG SOAL SELIDIK INI!

—Soal selidik tamat—

APPENDIX D

CREDENTIALS

Appendix D1: Credentials for Panel of Experts

DISTINGUISHED PROFESSOR DR TIMOTHY TEO	
Name	Timothy Teo
Designation	Distinguished Professor
Affiliation	Discipline of Education, Murdoch University, Australia
Qualification	PhD in Psychological Studies Academic Group, National Institute of Education. Master of Arts in Visual and Performing Academic Group, Nanyang Technological University. Bachelor of Arts, University of Canterbury Bachelor of Arts, University of Auckland Certificate in Education, Institute of Education
Expertise	ICT in Education, Educational Psychology, Educational and Social Measurement, Psychometrics, Research Methods, Quantitative Data Analysis, Music Education, and Psychology of Music
ORCID	https://orcid.org/0000-0002-7552-8497
Scopus ID	https://www.scopus.com/authid/detail.uri?authorId=23398283800
Google Scholar	https://scholar.google.com.au/citations?hl=en&user=NLCN-EQAAAAJ

DISTINGUISHED PROFESSOR DR FU-YUN YU	
Name	Fu-Yun Yu
Designation	Distinguished Professor
Affiliation	Institute of Education, National Cheng Kung University
Qualification	PhD in Educational/Instructional Technology, the University of Texas at Austin Master of Arts in Educational System Development, Michigan State University Bachelor of Arts in Library and Information Science, National Taiwan University
Expertise	Innovative Teaching, Learning and Assessment Strategy, Online Learning
ORCID	https://orcid.org/0000-0001-8583-6402
Scopus ID	https://www.scopus.com/authid/detail.uri?authorId=7402816695
Google Scholar	https://scholar.google.com/citations?user=Z2jn5LAAAAAJ&hl=zh-TW

PROFESSOR DR WONG SU LUAN	
Name	Wong Su Luan
Designation	Professor
Affiliation	Faculty of Educational Studies, Universiti Putra Malaysia
Qualification	Bachelor of Education, Universiti Putra Malaysia Master of Science, Loughborough University PhD, Universiti Putra Malaysia
Expertise	Integration of IT into pre-service teacher & in-service teacher education, Teaching & learning with IT, Constructivism in IT, Instrument development & validation
Google Sites	https://sites.google.com/site/wongsuluan/
Google Scholar	https://scholar.google.com.my/citations?user=hXFyaVYAAAAJ&hl=en

Appendix D2: Credentials for Language Experts

MR ZULKUFLI BIN MAHAYUDIN	
Name	Zulkufli bin Mahayudin
Designation	Lecturer
Affiliation	Institute of Teacher Education (Ipoh Campus)
Qualification	Sijil Perguruan Malaysia (Maktab Perguruan Kuala Terengganu Batu Rakit Terengganu). Pengajian Melayu Bacelor of Education (Universiti Sains Malaysia) Master of Education (Curriculum)
Expertise	18 years teaching Education Subjects (Philosophy of Education, Psychology of Education, Child Development, Pedagogy, etc.) Classroom Assessment, The 21 st century Education
Award	Anugerah Perkhidmatan Cemerlang 2005 Anugerah Perkhidmatan Cemerlang 2012 Anugerah Penceramah Pengajaran dan Pembelajaran 2012 (INTIM – Institut Tadbiran Islam Malaysia) Sijil Penghargaan (Instructional Coaching – JPN, PPD)

MS KOCK YOKE LENG	
Name	Kock Yoke Leng
Designation	Teacher
Affiliation	Wesley Methodist School Kuala Lumpur (International)
Qualification	Bachelor of Arts English Education (Universiti Tunku Abdul Rahman) Master of Linguistics (Universiti Malaya)
Expertise	Teaching English (IGCSE Curriculum)

MS ASHA M VANUGOPAL	
Name	Asha M Vanugopal
Designation	Lecturer
Affiliation	Department of Modern Languages, Faculty of Creative Industries, Univerisiti Tunku Abdul Rahman
Qualification	Master of Education, Universiti Putra Malaysia (Teaching of English as a Second Language) Bachelor of Arts (Hons), Universiti Putra Malaysia (English Language)
Expertise	Teaching of English as a Second Language

Appendix D3: Credentials for SEM Expert

ASSOCIATE PROFESSOR DR CHAM TAT HUEI	
Name	Cham Tat Huei
Designation	Associate Professor
Affiliation	UCSI Graduate Business School, UCSI University
Qualification	Doctor of Philosophy in Business and Service Marketing, Universiti Tunku Abdul Rahman Master of Arts in Management Studies, University of Hertfordshire Master of Business Administration, INTI International University Bachelor of Business Administration (Hons) in Entrepreneurship, Universiti Tunku Abdul Rahman
Expertise	Trainer for: • IBM Statistical Package for the Social Sciences (SPSS) Software • IBM Analysis of a Moment Structures (AMOS) Software • Business Research Methodology
Award	Best Paper Award, International Postgraduate Symposium in Tourism and Hospitality (IPSTH2020) Outstanding Paper Award, QS Subject Focus Summit Research Sharing Session, December 2018 Best Paper Award, MAG Scholar Conference, June 2018 Best Reviewer Award, Asian Journal of Business Research, 2017/2018
ORCID	orcid.org/0000-0001-7636-5928
Scopus ID	57035596700M-4046-2018
Google Scholar	https://scholar.google.com.my/citations?user=IwQgiNMAAAAJ&hl=en

APPENDIX E

DATA

Appendix E1: Common Method Bias

Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	27.270	39.522	39.522	26.700	38.696	38.696
2	3.972	5.757	45.279			
3	3.003	4.352	49.631			
4	2.357	3.415	53.046			
5	1.815	2.631	55.677			
6	1.663	2.411	58.088			
7	1.398	2.026	60.114			
8	1.269	1.839	61.952			
9	1.166	1.690	63.643			
10	1.059	1.534	65.177			
11	.989	1.433	66.610			
12	.958	1.389	67.999			
13	.915	1.326	69.325			
14	.866	1.255	70.580			
15	.847	1.228	71.808			
16	.801	1.160	72.968			
17	.776	1.124	74.092			
18	.720	1.043	75.136			
19	.693	1.005	76.140			
20	.667	.967	77.107			
21	.648	.939	78.046			
22	.602	.873	78.919			
23	.589	.854	79.772			
24	.575	.833	80.606			
25	.567	.821	81.427			
26	.546	.792	82.218			
27	.528	.765	82.984			
28	.493	.714	83.698			
29	.487	.706	84.403			
30	.483	.699	85.103			
31	.456	.660	85.763			
32	.452	.655	86.419			
33	.448	.649	87.068			
34	.433	.627	87.695			
35	.403	.584	88.279			
36	.397	.576	88.855			
37	.372	.540	89.395			

38	.364	.528	89.923			
39	.343	.498	90.420			
40	.339	.492	90.912			
41	.334	.485	91.397			
42	.324	.469	91.866			
43	.319	.462	92.328			
44	.312	.452	92.780			
45	.299	.433	93.213			
46	.288	.417	93.630			
47	.278	.402	94.033			
48	.267	.387	94.419			
49	.253	.367	94.787			
50	.245	.355	95.141			
51	.236	.342	95.484			
52	.232	.337	95.820			
53	.226	.327	96.147			
54	.221	.320	96.468			
55	.215	.312	96.779			
56	.201	.292	97.071			
57	.197	.286	97.357			
58	.194	.281	97.638			
59	.187	.271	97.909			
60	.183	.265	98.174			
61	.175	.254	98.428			
62	.164	.238	98.666			
63	.159	.230	98.896			
64	.150	.217	99.114			
65	.145	.210	99.323			
66	.139	.201	99.524			
67	.126	.183	99.708			
68	.113	.163	99.871			
69	.089	.129	100.000			

Extraction Method: Principal Axis Factoring.

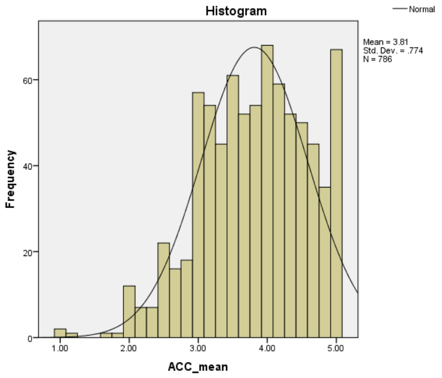
Appendix E2: Normality Test

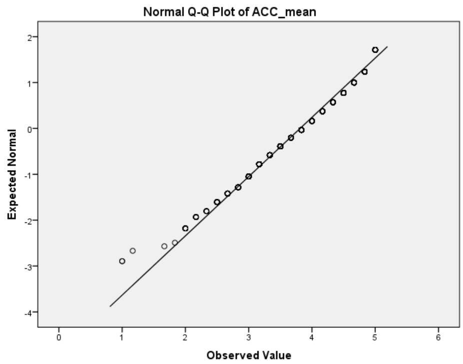
Attitude towards Career Choice

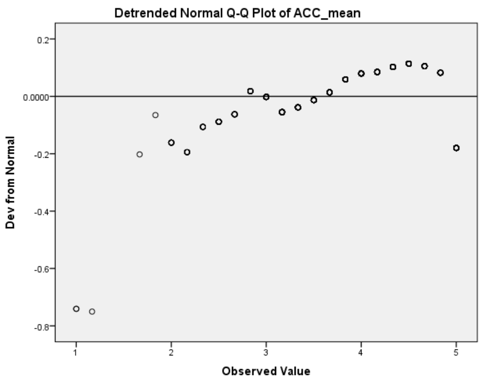
Tests of Normality

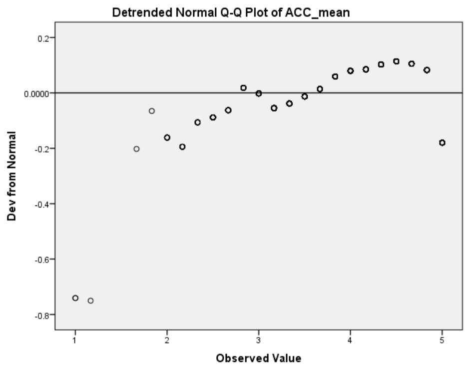
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
ACC_mean	.074	786	.000	.969	786	.000

a. Lilliefors Significance Correction







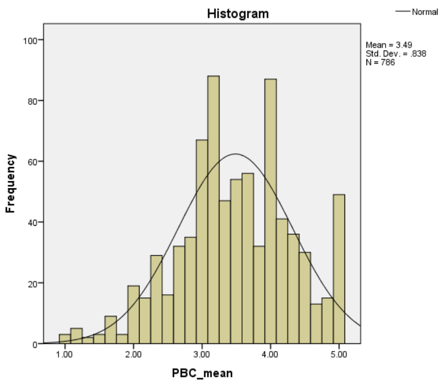


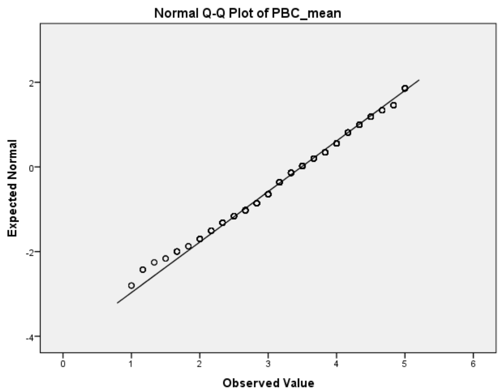
Perceived Behavioural Control

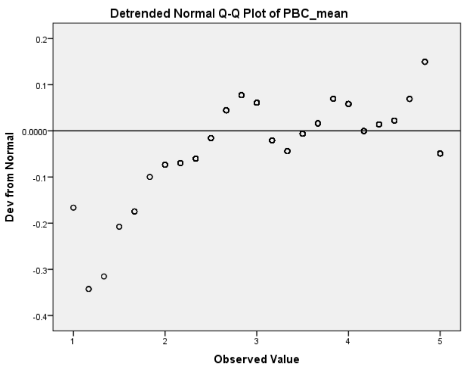
Tests of Normality

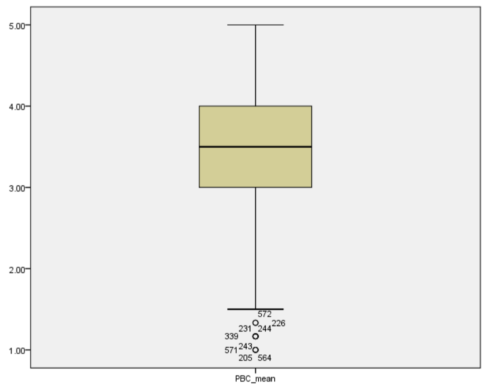
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PBC_mean	.075	786	.000	.981	786	.000

a. Lilliefors Significance Correction







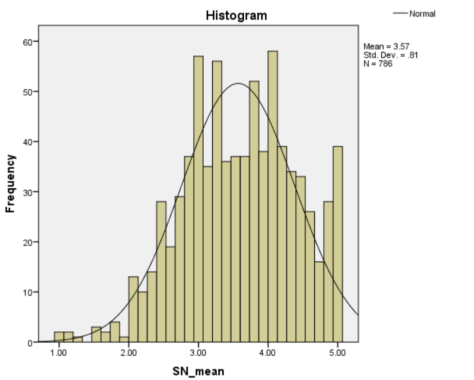


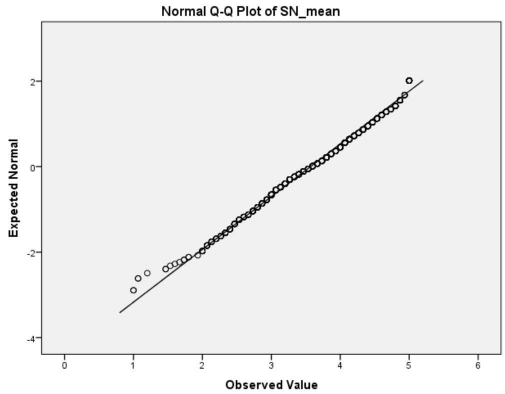
Subjective Norms

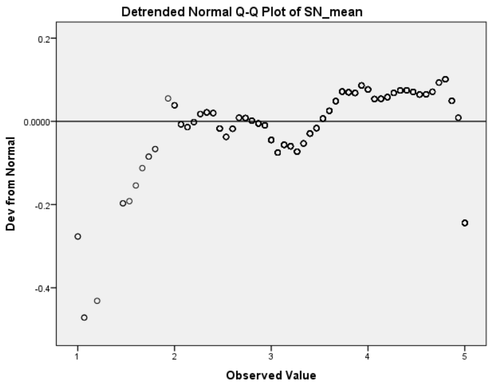
Tests of Normality

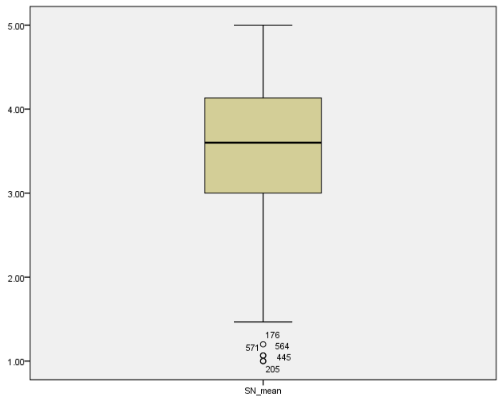
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SN_mean	.050	786	.000	.984	786	.000

a. Lilliefors Significance Correction







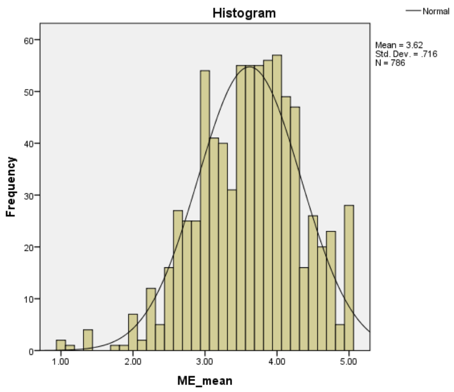


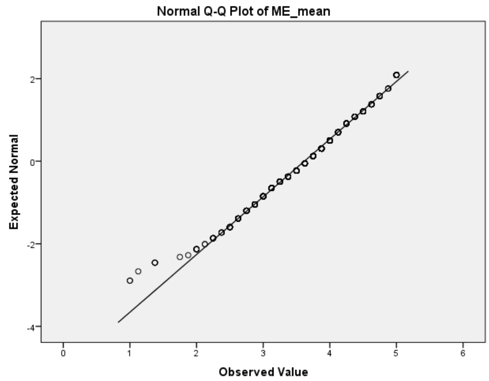
Media Exposure

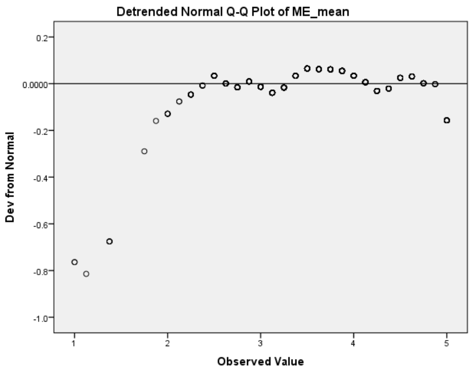
Tests of Normality

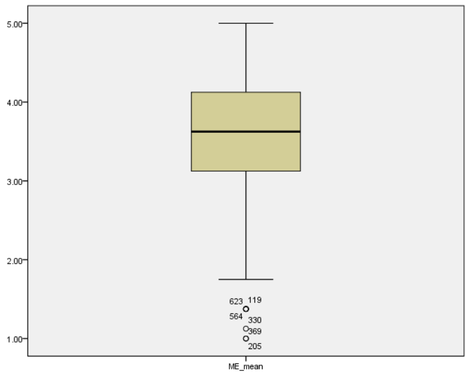
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
ME_mean	.060	786	.000	.985	786	.000

a. Lilliefors Significance Correction







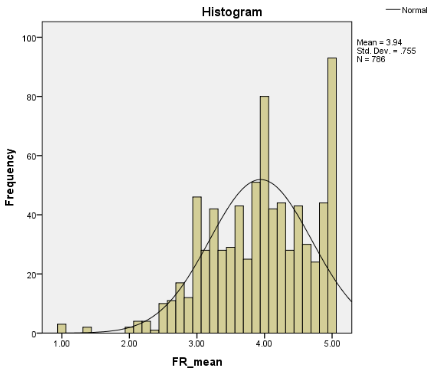


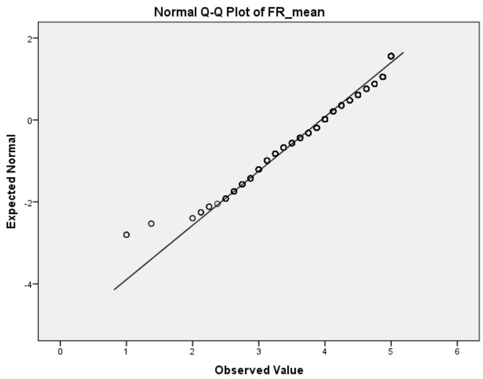
Financial Reward

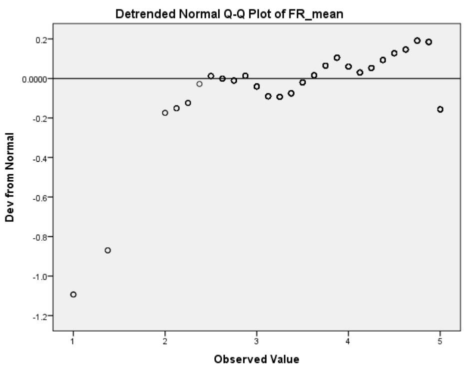
Tests of Normality

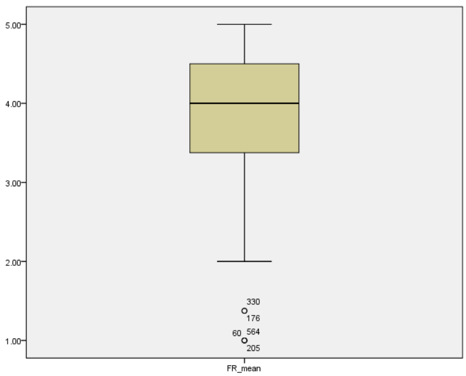
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
FR_mean	.081	786	.000	.955	786	.000

a. Lilliefors Significance Correction







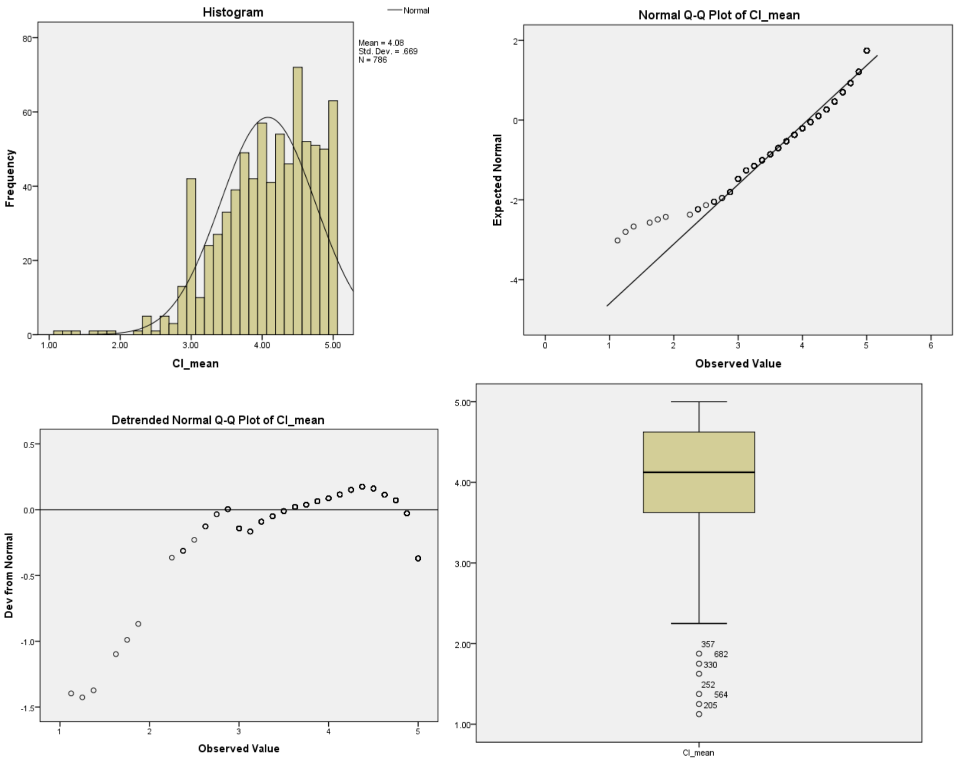


Career Interest

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
CI_mean	.101	786	.000	.945	786	.000

a. Lilliefors Significance Correction

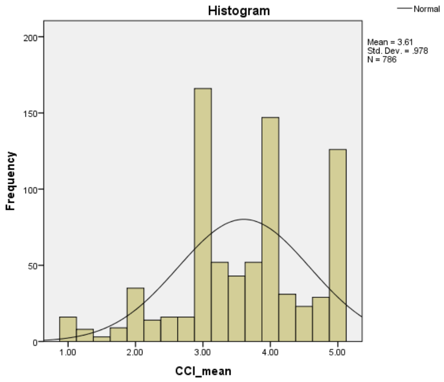


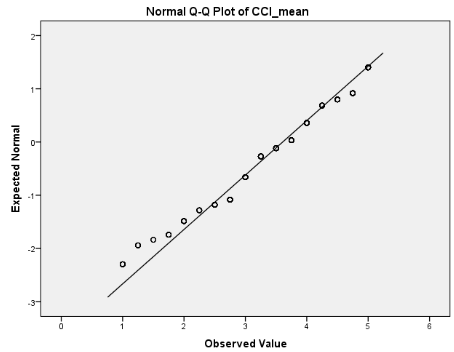
Career Choice Intention

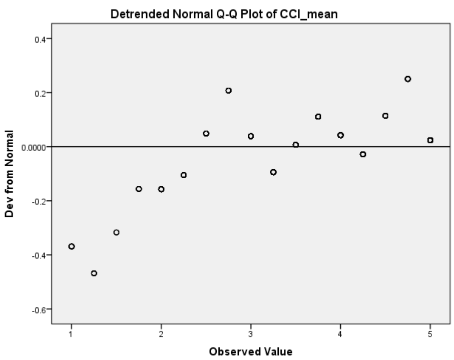
Tests of Normality

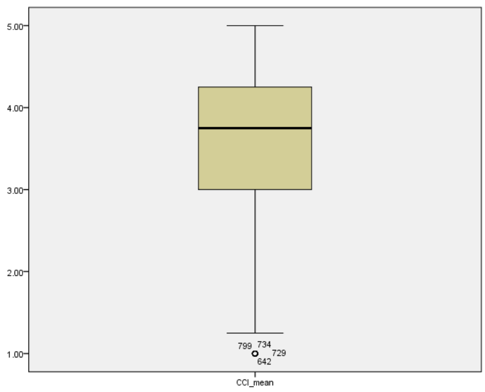
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
CCI_mean	.118	786	.000	.941	786	.000

a. Lilliefors Significance Correction



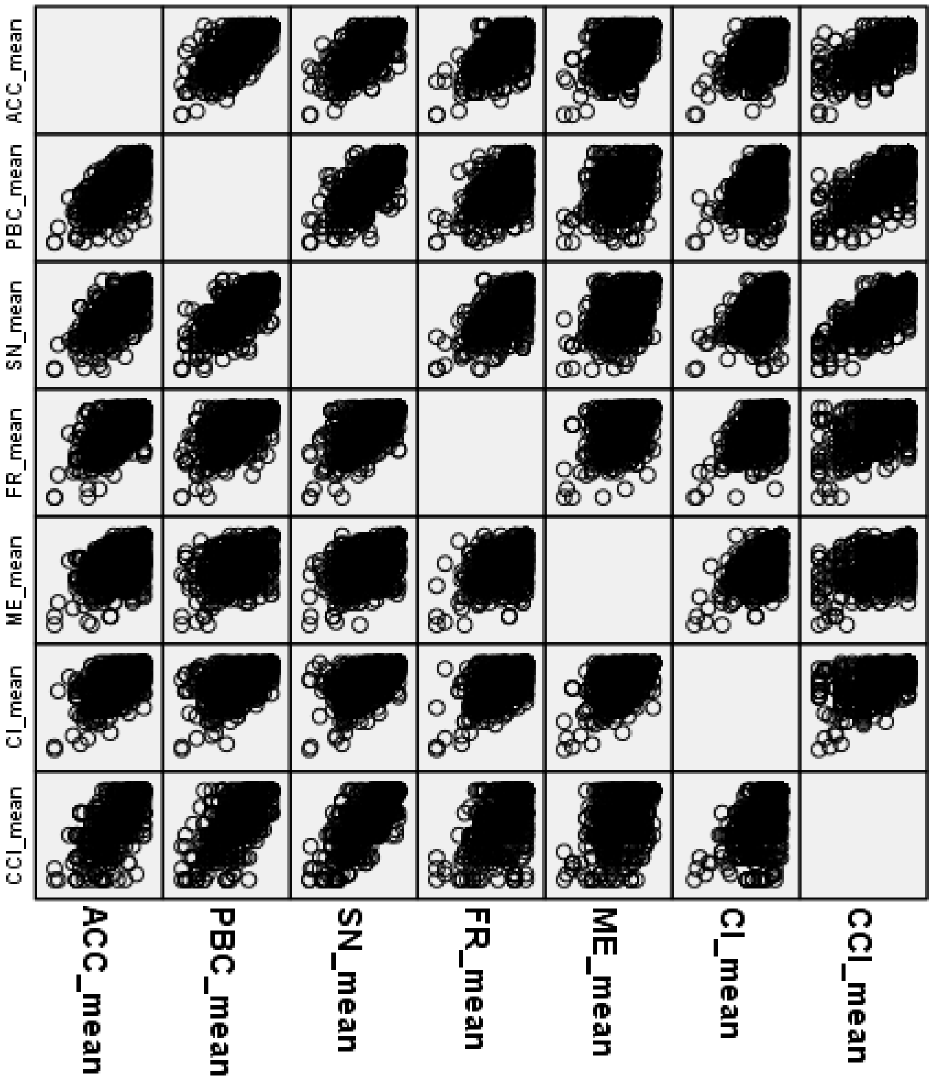




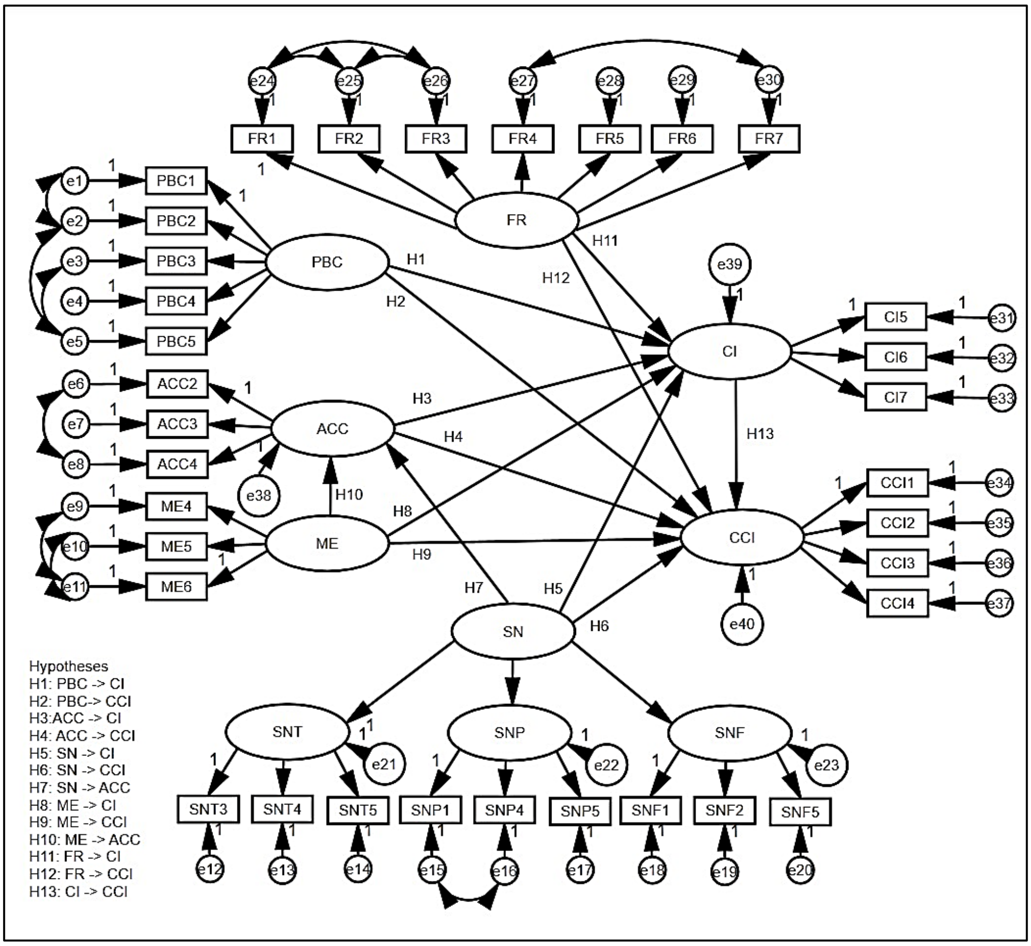


Appendix E3: Linearity Test

Matrix Scatterplot



Appendix E4: Conceptual Framework in SEM



APPENDIX F

BIODATA OF THE STUDENT

Tiny Tey Chiu Yuen was born on 18th September 1991 in Johor, Malaysia. She received her primary, secondary and post-secondary education in her hometown. In 2011, she began her tertiary education at Universiti Tunku Abdul Rahman (UTAR) for the degree of Bachelor of Arts (Hons) in English Education. She was trained to teach English during her first degree and had the opportunity to teach English as a second language in an international school.

In 2014, Tiny Tey began her postgraduate studies in Master of Philosophy (MPhil) in Social Science at her alma mater. She was awarded an 18-month scholarship from the Malaysian Ministry of Higher Education under the Mybrain15 programme. Besides, she also received a one-year research scholarship scheme from her university during the first year of her master's degree which she also worked as a research assistant under a project led by her main supervisor. Besides, she also had the opportunity to teach English for Business for one semester under the supervision of her main supervisor.

In 2015, she was recommended by her supervisor and dean to work as a corporate communication and public relations officer. The three-year working experience helped her to develop new skills in corporate writing, media relations, translation and event coordination. Her tenure at the position offered her invaluable exposure to STEM education, media and communications, and helped her to expand her interests in these areas. While working full-time, she completed her research titled "An Extension of Unified Theory of Acceptance and Use of Technology Model: Exploring the Antecedents of Technology Use" and graduated with Master of Philosophy (Social Science) in 2017.

Tiny Tey's passion for education and quest for knowledge motivated her to embark on her PhD journey in 2018. Her candidacy at UTAR in Doctor of Philosophy (Social Science) was supported by her university through a PhD Research Scholarship Scheme under a research project initiated by her main supervisor together with her co-supervisor. Besides STEM, her research interests also include educational technology, students' learning behaviour, educational policy, and teaching and learning. She is enthused to constantly work with experts in the subject matter and seek opportunities to publish in these fields. While working on her PhD research, she has had the opportunity to work closely with a research team that consists of experts from local and international universities. She has also assisted in several other research teams and professional bodies under the supervision of her supervisors to support their research projects and training. These experiences have also sparked her interests in policing, healthcare, and training.

ORCID ID : 0000-0001-7039-2183
Scopus Author ID : 56535291400
Google Scholar ID : Tey Tiny Chiu Yuen

APPENDIX G

PUBLICATIONS RELATED TO THIS THESIS

Journal Articles

Tey, T. C. Y., Moses, P., & Cheah, P. K. (2020). Teacher, parental and friend influences on STEM interest and career choice intention. *Issues in Educational Research*, *30*(4), 1558-1575. http://www.iier.org.au/iier30/tey.pdf [*Indexed in Web of Science (ESCI); Scopus*]

Tey, T. C. Y., Moses, P., & Cheah, P. K. (2019). Human capital in STEM: The influence of attitude, subjective norm and perceived behavioural control on career choice. *Jurnal Penyelidikan Dedikasi Khas*. *16*, 106-118. http://myjms.mohe.gov.my/index.php/jd/article/view/12359 [*Indexed in MyJurnal*]

International Proceedings

Moses, P., & **Tey, T. C. Y**., & Cheah, P. K. (2021). STEM and Non-STEM students' perception towards work environment and career prospect. In Rodrigo, M. M. T. et al. (Eds.), *Proceedings of the 29th International Conference on Computers in Education*. Asia-Pacific Society for Computers in Education (APSCE). https://icce2021.apsce.net/wp-content/uploads/2021/12/ICCE2021-Vol.I-PP.-157-162.pdf [*Indexed in Scopus*]

Moses, P., Cheah, P. K., & **Tey, T. C. Y.**, & Chiew, J. X. (2020). Development of the theory of planned behaviour questionnaire: Students' career choices in STEM. In H. -Y. So, M. M. Rodrigo, J. Mason, & A. Mitrovic (Eds.), *Proceedings of the 28th International Conference on Computers in Education: Proceedings Volume II* (pp. 292-302). Asia-Pacific Society for Computers in Education (APSCE). https://apsce.net/upfile/icce2020/ICCE2020-Proceedings-Vol2-FinalUpdated.pdf [*Indexed in Scopus*]

Tey, T. C. Y., Moses, P., Cheah, P. K., & Wong, S.L. (2019). Malaysian students' career interest and perception towards STEM programmes and strategies. In M. Chang, H. J. So, J. -L. Wong, & F. -Y. Yu (Eds.), *Proceedings of the 27th International Conference on Computers in Education: Proceedings Volume II* (pp. 110-118). Asia-Pacific Society for Computers in Education (APSCE). https://apsce.net/icce/icce2019/dw/ICCE2019%20Proceedings%20Volume%20II.pdf [*Indexed in Scopus*]

Moses, P., Cheah, P. K., & **Tey, T. C. Y.** (2018). Reconsidering digital natives' career choice intention in STEM via TPB, SCCT and media exposure. In Y., -T. Wu, N. Srisawasdi, M. Banawan, J. C. Yang, M. Chang, L. -H. Wong, & M. M. T. Rodrigo. (Eds.), *Workshop Proceedings of the ICCE 2018 - 26th International Conference on Computers in Education,* 291-298. https://apsce.net/icce/icce2018/icce2018/2%20ICCE%202018%20Workshop%20Proceedings.pdf [*Indexed in Scopus*]

Abstract/ Poster

Tey, T. C. Y., Moses, P., & Cheah, P. K. (2019, July 23-25). Human capital in STEM: The influence of attitude, subjective norm and perceived behavioural control on career choice [Conference presentation abstract]. *International Conference on Education and Teacher Development (ICETD2019)*, Perak, Malaysia.

Moses, P., Cheah, P. K., & **Tey, T. C. Y.** (2018, October 26). *Discovering school students' career choices in STEM via subjective norms* [Conference presentation abstract and poster]. International Conference on Recent Trends in Humanities and Science 2018. Perak, Malaysia: American J of Bio-pharm Biochem and Life Sci, V6: OP41. http://www.ajbbl.com/html/AJBBL_2018/PDF/OP%2041.pdf

News

Rajasakran, T. (2021, September 16). *Parents, teachers and friends key to spurring interest in STEM*. New Straits Times. https://www.nst.com.my/opinion/letters/2021/09/727865/parents-teachers-and-friends-key-spurring-interest-stem?fbclid=IwAR0070H8yYuLSQMNY2p2otMYxNjz1qT25-x_n3yAwbU3GjqahWV9_Esc_w8 [*Partial findings of this thesis are shared to the public in the news article*]